COMMONWEALTH AGRICULTURAL BUREAUX

THIRTY-SECOND ANNUAL REPORT

OF THE EXECUTIVE COUNCIL

1960-61

INCLUDING NOTES OF PROGRESS
IN THE AGRICULTURAL SCIENCES

LONDON: HER MAJESTY'S STATIONERY OFFICE

FIVE SHILLINGS NET

COMMONWEALTH MYCOLOGICAL INSTITUTE
16 NOV 1961

COMMONWEALTH AGRICULTURAL BUREAUX
EXECUTIVE COUNCIL

(31st March, 1961)

Member:	*Representing:*
C. KEMAL REHEEM (Chairman)	Pakistan
V. ARMSTRONG, Ph.D. (Vice-Chairman)	New Zealand
W. G. ALEXANDER, C.B.E.	United Kingdom
J. G. MALLOCH, M.B.E., Ph.D.	Canada
E. J. DRAKE	Australia
J. F. BROOKS	Union of South Africa
A. M. D'ROZARIO, Ph.D.	India
A. PERERA	Ceylon
(To be nominated)	Ghana
YUSOFF BIN ZAINAL	Federation of Malaya
(To be nominated)	Federation of Nigeria
J. E. C. COVENTRY	Federation of Rhodesia and Nyasaland
W. A. C. MATHIESON, C.M.G., M.B.E.	Colonial Territories
E. L. HAY, M.B.E. (Acting Secretary)	

COMMONWEALTH AGRICULTURAL BUREAUX

Thirty-second Annual Report

of the Executive Council

1960-61

LONDON: HER MAJESTY'S STATIONERY OFFICE
1961

CONTENTS

	Page
Preface	3
Report	6
General News	6
Recommendations of the 1955 Review Conference	11
The Review Conference of 1960	11
Membership of the Executive Council	12
Liaison Officers	12
Staff Changes	13
Visits Overseas	13
Attendance at Conferences and Committees	14
Visits to Institutes and Bureaux by Overseas Scientists	16
Publications	16
Summaries of Annual Reports, by Directors	19
Commonwealth Institute of Entomology	19
Commonwealth Mycological Institute	21
Commonwealth Institute of Biological Control	26
Commonwealth Bureaux	27
Notes of Progress in the Agricultural Sciences, by Directors	32
Finance	43
Statements of Accounts:	
Commonwealth Agricultural Bureaux	45
Commonwealth Institute of Entomology	46
Commonwealth Mycological Institute	47
Commonwealth Institute of Biological Control	48
List of Sanctioned Staff	50
List of Liaison Officers	51
Addresses	52

PREFACE

The Imperial Agricultural Research Conference, 1927, stressed (*a*) the need for scientists to be in touch with the progress of research throughout the world in their several branches, and (*b*) the difficulty therein owing to the great output of scientific literature and the diversity of languages in which it is published.

2. It recommended the governments of the British Commonwealth to establish on a joint co-operative basis eight bureaux to collect, collate and disseminate information on research in eight selected branches of agricultural science, and generally to assist research workers in the Commonwealth and Empire with information relevant to their subjects. Each bureau was to be located at a research institute specialising in its own branch of science so that the bureau officers should be in daily contact with men engaged on research in its own subject. These bureaux were to be financed from a common fund contributed by Commonwealth governments in agreed proportions and controlled by a Council composed of representatives of those governments on an equal footing.

3. Governments accepted these proposals. In November, 1928, a new type of inter-imperial co-operative agency acceptable to all governments was worked out in detail. On 1st April, 1929, the Executive Council of the Imperial Agricultural Bureaux came into being. The eight bureaux started work in that year. From 1st January, 1948, the name of the organisation was changed to Commonwealth Agricultural Bureaux.

4. Following the Ottawa Conference of 1932, the work of several inter-imperial agencies was examined and reported upon by the Imperial Committee on Economic Consultation and Co-operation (1933). This committee approved of the bureaux organisation and of its work and extended the duties of the Council, inter alia, proposing that with effect from 1st October, 1933, they should also be responsible for the supervision and administration and finance of the Imperial Institute of Entomology and of the Imperial Mycological Institute.

5. It also enunciated certain general principles to be observed in regard to the organisation of agencies of inter-imperial co-operation and consultation, e.g., constitutional equality of participating governments in the appointment of the authority administering the work; the provision of adequate finance for a definite period of years; careful and periodical examination of the work and organisation of the agency at the Commonwealth conferences suitable for the purpose, as without that assurance governments could hardly be expected to provide the adequate continuing finance; and the responsibility of the administering authority to all participating governments. All governments accepted this report.

6. The British Commonwealth Scientific Conference (1936) conducted the first of these 'periodical examinations'. It approved both the work and organisation. It recommended the finance necessary until 1941-42 (extended later to cover the war period), its distribution between governments, also the formation of two more bureaux, and certain modifications in practice designed to improve general efficiency. Governments accepted these proposals.

7. A Review Conference was held in the summer of 1946, just one year after the close of the war. This was the first since 1936 and was only the second "periodical examination" since the recommendations of the Imperial Committee on Economic Consultation and Co-operation in 1933. The Review Conference, 1946, recommended that the Parasite Service should continue to be located at Belleville, Canada, that it should become an individual bureau and that its name should be changed to the Bureau (now Institute) of Biological Control to denote its separate entity. It also recommended that information on general husbandry should be provided within the framework of the existing bureaux which, in turn, necessitated the name of the Bureau of Pastures and Forage Crops being altered to Pastures and Field Crops. Both changes of name were made on 1st April, 1947, the opening date of the period to which the recommendations of the conference referred. It recommended the finance necessary until 1951-52 and its distribution between governments. Governments accepted these proposals.

8. The third periodical examination took place in June and July, 1950. With such a well-established organisation as this had now become, the conference was naturally concerned more with consolidation than with new developments. It did, however, lay stress on the need to continue the service; the mutual advantage of co-operation with international bodies, especially to avoid duplication of work; the possibility of foreign governments being associated with C.A.B.; and the desirability of extending the services of the Institute of Biological Control to foreign countries. It also approved the use of Farnham House for the accommodation of Headquarters and Central Sales, advised the formation of the Consultant Directors into a Scientific Advisory

Committee, approved the handing over of the Potato Collection to the Agricultural Research Council of the United Kingdom and provided funds to set up a new Bureau of Agricultural Economics though, for various reasons, the setting up of this bureau was deferred.

9. A further Review Conference was held in London in the summer of 1955. The Conference endorsed certain recommendations of the 1950 Conference, particularly in regard to co-operation with international bodies and association of foreign governments with the work of the Commonwealth Agricultural Bureaux, and modified others in the light of experience gained. The Conference suggested changing the name of the Bureau of Agricultural Parasitology (Helminthology) to Helminthology, of the Bureau of Dairy Science to Dairy Science and Technology and of the Bureau of Soil Science to Soils. It advocated increased superannuation benefits for C.A.B. staff, improved salaries for Assistant Directors, provision for taxonomic and identification services in helminthology and coverage of literature on weed control. It deferred action on matters like the proposed Bureau of Agricultural Economics and the establishment of a laboratory of the Institute of Biological Control in East Africa but recommended a grant towards the journal of The National Institute of Agricultural Engineering pending a decision on the proposed Bureau of Agricultural Engineering at the next Conference. Finally, it recommended the finance needed till 1961-62 but called for a re-examination of the allocation of units of contribution to the C.A.B. Organisation.

10. The last Review Conference was held in the autumn of 1960. A section of the report deals with action on the recommendations of this conference but it is worthwhile recording here the opening recommendation which reiterated the words of the 1955 Conference thus:

> "(1) The Conference is firmly persuaded, as a result of the inspections and discussions which have taken place during its progress, that the Commonwealth Agricultural Bureaux Organisation provides an information service on scientific work in agriculture and forestry throughout the world which is of vital importance for agricultural development and thus for the production of food and the maintenance of living standards; that such a comprehensive service is not provided anywhere else and could not be provided by either national or international organisations so cheaply or so efficiently; and that the cost of the service is very small in relation to the value of agricultural and forestry production in the contributing countries."

11. The C.A.B. Review Conference 1960 endeavoured to frame recommendations which would not only ensure the full and efficient maintenance of existing services and provide for a very small degree of expansion, but would also leave the door open for further enlargement of the field of activities at a later date. The keynote of the Conference was the careful reappraisal of C.A.B. activities, with due regard to the primary purposes for which the organisation was set up. The Conference instituted enquiries both into the techniques of preparing the abstracts and into the production, publication and sales of the abstract journals. In view of the need for economy, no new bureaux were to be opened but the grants already being given to *World Agricultural Economics and Rural Sociology Abstracts* and *Agricultural and Horticultural Engineering Abstracts* were to be increased and a small grant also made for the continuance of *Apicultural Abstracts*. One of the conditions attaching to these grants was the supply of copies of journals under the free quota system, which was expanded to make a greater number available in future to contributing countries. The Review Conference called for an interim conference in 1963 which would in turn appoint an *ad hoc* committee to study the long term problems of the Commonwealth Agricultural Bureaux with particular reference to the method of determining the units of financial contribution to be assessed to contributing countries, the possibility of locating bureaux and institutes throughout the Commonwealth, the possibility of separating the research and service functions of the three institutes from the C.A.B. organisation and making them self-supporting, and the long-term development of the C.A.B. organisation.

12. The institutes and bureaux act as effective clearing houses of information for scientists and research workers in agriculture and forestry throughout the Commonwealth and, increasingly, throughout the world. To do this they collect information by scanning and indexing as far as possible all journals in their subjects in all languages, by scanning other abstracts, and by keeping in touch with research in progress. They distribute this information by the periodical issue of 15 abstract and three other journals, by the frequent issue of monographs reviewing some particular subject within their field and by various other publications.

13. Apart from the printed record, the institutes and bureaux serve as intelligence centres in a variety of other ways. They may answer individual enquiries, an activity that ranges from supplying a few references to furnishing a bibliography, a basic library list, or a memorandum of digested information. Several bureaux may co-operate in this, particularly where information marginal to their interest is concerned. They may also supply reprints, photo-reproductions or microfilms of

material inaccessible to an enquirer. They also assist research workers by giving information about research centres, by arranging meetings between workers in different parts of the Commonwealth, by arranging the exchange of experimental material between workers, by giving information on post-graduate study, on the sources of supply of apparatus and equipment, and so on. In addition the notes of progress in the agricultural sciences, as published in the Annual Reports, are designed to keep scientists informed of the most recent advances in their subjects. It is stressed that any scientist is free to send enquiries straight to the Director concerned. The Institute of Entomology and the Mycological Institute have the important additional duty of identification, each in its own field.

14. The Institute of Entomology maintains no collection of its own, as its work is integrated very closely with the British Museum, but the Mycological Institute keeps its own working herbarium which now contains some 85,000 specimens. It also maintains the United Kingdom national collection of type cultures for all fungi except medical fungi, timber rotting fungi and yeasts.

15. The Institute of Biological Control prepares and maintains a catalogue of the parasites and predators of the insects of the world. Part 5 of Section 2 is the last published. The principal activity of this institute is, however, in the practical field. It consists mainly of the supply of beneficial insects attacking various pests. This requires field survey collections and sometimes mass breeding and the development of special methods of shipment. There are stations in Europe, India, Pakistan, West Indies and the United States. In addition to the supply of parasite material, the institute takes complete charge of biological control projects for governments. The institute also carries out research and educational work.

16. A brief summary of the work carried out at the institutes and bureaux during the year under review is given on pages 19-32.

17. The organisations under the administration of the Executive Council are:

The Commonwealth Institute of Entomology

The Commonwealth Mycological Institute

The Commonwealth Institute of Biological Control

The Commonwealth Bureaux of:

- Animal Breeding and Genetics
- Animal Health
- Animal Nutrition
- Dairy Science and Technology
- Forestry
- Helminthology
- Horticulture and Plantation Crops
- Pastures and Field Crops
- Plant Breeding and Genetics
- Soils

18. A Liaison Officer appointed by the appropriate department of each participating country keeps in touch with administrative matters, and in each country for each bureau a scientific officer is nominated as Official Correspondent to be the 'general friend' on scientific matters of that bureau in that country. A few bureaux also nominate Foreign Correspondents who are really the equivalent of Official Correspondents in foreign countries. The Secretary and each Director also has an opposite number named in F.A.O. with whom he corresponds directly. The Heads of the several institutes at which bureaux are located act as Consultant Directors of the Bureaux thus giving the Council and bureaux the benefit of their wide experience and scientific knowledge. Together they constitute the Scientific Advisory Committee. All other officers are whole-time servants of the Executive Council.

REPORT

The Executive Council of the Commonwealth Agricultural Bureaux at their meeting on 21st June, 1961, adopted the following report on their 32nd year of work—1st April, 1960, to 31st March, 1961. This is the fourth financial year of the review period, 1957-58 to 1961-62.

2. It was a year enlivened by final arrangements and documentation for the Review Conference and the Commonwealth Entomological and Mycological Conferences. It was a year too of sad farewells due to the death or retirement of people close to C.A.B. It nevertheless provided an opportunity for reappraisal and reassessment of C.A.B. values and gave promise for the future.

GENERAL NEWS

3. *The Commonwealth.* The Federation of Nigeria became an independent State within the Commonwealth on 1st October, 1960, and on 4th March, 1961, accepted the invitation of the Executive Council to continue its association with C.A.B.

Cyprus became independent on 16th August, 1960, and joined the Commonwealth on 13th March, 1961; but the Somaliland Protectorate on forming part of the independent Somali Republic severed its connection with C.A.B.

The accession of new member countries was a welcome sign of the growth and solidarity of the Commonwealth.

4. *Council Meetings.* The Executive Council held eight statutory meetings during the year at Africa House, and one at Farnham Royal. In addition, Council held five *ad hoc* meetings to consider the appointment of a Secretary, besides meeting the Scientific Advisory Committee and the Directors at their annual conferences.

With such a heavy programme before them, Council had recourse to the formation of various committees in addition to the Appointments Committee, e.g., a screening committee for the Secretaryship, and a panel of members to select an expert committee to enquire into the future of the Bureau of Helminthology, including its taxonomic unit, and to lay down its terms of reference.

5. *Recognitions and awards.* The honour of a Knighthood was conferred on Mr. Trotman, late Secretary of C.A.B., in the New Year Honours, but, as reported later, he did not live to receive the accolade.

The services of the Assistant Director of the Forestry Bureau, Mr. P. G. Beak, were recognised by the award of the M.B.E. in the New Year Honours.

Dr. Hopkins, Director, Mycological Institute, was elected Chairman of the London Branch of the Institute of Biology for 1960/61 and was co-opted to the Council of that Institute.

The Degree of Doctor of Science was conferred on Dr. Simmonds, Director, Institute of Biological Control, by the University of London on 14th December, 1960, for his "Work in the field of Entomology".

Mr. Maule, Director, Bureau of Animal Breeding and Genetics, was elected Vice-President of the British Society of Animal Production in March, 1961.

Dr. Hudson, Director, Bureau of Plant Breeding and Genetics, was elected a Corresponding Member of the Accademia dei Georgofili in Florence.

6. *Accommodation.* The Executive Council are indebted to the B.C.S.O. (London) Committee for the facilities provided at Africa House, often at short notice, for their own and other C.A.B. Meetings. Council, however, decided to relinquish from 1st July, 1960, the room on the third floor which they had rented for the occasional use of the Secretary and staff but which in practice was mainly used for candidates awaiting interview.

Recommendations were made by the C.A.B. Review Conference, 1960, for provision of laboratory buildings for the European and West Indian Stations of the Institute of Biological Control. Financial provisions have been made, in the latter case with the aid of 75 per cent of the costs provided (to the Government of the West Indies Federation) from Colonial Development and Welfare funds.

The Director, Bureau of Animal Breeding and Genetics, reports that plans for the new headquarters of the Animal Breeding Research Organisation of the Agricultural Research Council have now been completed and approved and building is expected to start in August or September, 1961. Accommodation is provided in this building for the Bureau, with adequate library space.

The shortage of accommodation for the Bureau of Animal Nutrition is such that there is no room for two Scientific Assistants; through the kindness of the Consultant Director and the Librarian of the Reid Library they have been given working space in alcoves in the Library.

A start was made in the autumn with the fourth storey of the Imperial Forestry Institute building, but no move into the rest of the existing wing seems possible until the end of the summer term to relieve the Forestry Bureau's state of chronic congestion.

Meanwhile, all arrangements have been made for equipping the spacious new typists' room to ensure maximum efficiency.

Major repairs to parts of Bradbourne House occupied by the Bureau of Horticulture & Plantation Crops were completed early in 1961, several new rooms being created by dividing or adapting parts of Bradbourne that had previously been little or never used. Today the accommodation provided is better and brighter than at any time in the past.

The Director reports plans for an extension of the Bureau of Soils' present accommodation.

Special Projects

7. *Entomology and Pathology.* A list of monographs proposed by Dr. Randhawa, leader of the Indian delegation to the Review Conference, was referred to Council who, in accepting the Director's advice, directed that every effort be made to find suitable authors in appropriate cases.

8. Two publications of the Mycological Institute have proved of immediate success, namely, the 5th edition of *Ainsworth & Bisby's Dictionary of Fungi* and the *Herb I.M.I. Handbook.*

9. *Biological Control.* As an indication of the demand by Commonwealth countries for the services of the Institute of Biological Control, it is of interest to note that project fund expenditure during the year under report was approximately $98,500.00. In addition to the examples of international co-operation recorded last year, which have continued, the Institute developed an exchange of material with Hawaii to the mutual advantage of all concerned. The projects in India and Pakistan financed through U.S.A. Public Law 480 funds have now been started. The work carried out to date and the general *modus operandi* have been so satisfactory that further projects financed in the same way are being considered, to the advantage of Commonwealth countries.

10. Projects have been carried out for the U.S.A. (the P.L. 480 projects mentioned above, and also work for the Marianas and the Virgin Islands (U.S.)) at the Indian, Pakistan and West Indian Stations. Projects for Russia (on an exchange basis for material supplied to Canada) have been carried out at the Californian Station and one for Israel at the West Indian Station.

11. A second contribution to the general review of biological control in the Commonwealth has been prepared by the Canadian authorities and it is hoped that the Institute will publish this in 1961-62 as the second Technical Communication of this series, similar to the one already done for Australia.

12. *Nutrition.* By the end of the year, the draft scheme for the *Classification of Knowledge of Nutrition for Coding and Machine Retrieval* was at the stage of being almost ready for circulation for comment. As a result of meetings with interested groups held, one in Vienna attended by Dr. Duncan and Dr. Leitch and the other in Karlsruhe at which Dr. Leitch was present, circulation was planned so that copies would reach nutrition workers and information centres in the Commonwealth, on the continent of Europe and in the United States of America. A paper describing the coding system to be applied to the *Classification*, the work of Mr. W. Z. Billewicz, Statistician in the Obstetric Medicine Research Unit (M.R.C.) Midwifery Department, University of Aberdeen, was prepared for publication. Mr. Billewicz's co-operation in devising the coding system and his knowledge and experience in the use of Hollerith machines have been indispensable for bringing the work to its present advanced state.

13. Inconvenience was caused by an outbreak of foot-and-mouth disease in Aberdeenshire and by the occurrence of cases within two miles of the Rowett Research Institute. Access by the Bureau staff to the Reid Library was prohibited for all but the Assistant Director, one Scientific Assistant and the Senior Clerical between 28th November and 12th December, and the ban was extended in the case of the Indexer until 9th January because of the appearance of the disease within a short distance of her home in the county. The effect was in one way beneficial since outside abstractors on the staff of the Rowett Institute, relieved of their laboratory work, were able to spend their enforced inactivity in preparing their abstracts for the journal, *Nutrition Abstracts and Reviews.*

14. Volume 30 was exceptional in that all four review articles were by authors who had close associations with the Bureau or the Rowett Institute. The first was by Dr. Garton of the Rowett Institute. Mrs. Aitken was the senior author of the second and third, one with Dr. Duncan and the other with Dr. Hytten of the Obstetric Medicine Research Unit (M.R.C.) as co-author. The fourth was by Dr. Leitch in association with Mr. Boyne of the Rowett Institute. It was the third of an important series of studies in which they have examined secular change in height of British adults (Volume 24, p. 255), secular change in height and weight of British children, including an analysis of British measurements of English children in primary schools, 1911-1952 (Volume 27, p. 1), and now recent change in the height and weight of adolescents (Volume 30, p. 1173).

15. *Forestry.* The printed French version of the *Oxford System of Decimal Classification for Forestry* was at last issued, in the summer of 1960. The Italian version has been vetted by the Bureau and its main section is now in the press. A start has been made on a Portuguese version, and parts of it are now being checked by the Bureau.

16. An article on the work of the Joint FAO/IUFRO Bibliographical Committee appeared in Vol. 14 (2) of *Unasylva*, incorporating advice on filing films according to the Oxford Classification. Both *Unasylva* (in FAO's 3 official languages) and *Forestry Abstracts* published the third list of amendments to the System, and German versions appeared by arrangement in the chief forestry journals of Germany, Austria and Switzerland.

17. Advice on classification was given to the Director of Forestry, Alberta, to Prof. Sundberg of Stockholm, and to Prof. Thirgood, Syracuse University, U.S.A.

18. The illustrated brochure on the work and growth of the Bureau (a Synopsis of the Work & Growth of the Commonwealth Forestry Bureau, Oxford, 1939-1959) was published just in time for the Review Conference and disseminated widely to the chief forestry journals and selected people all over the world. It has received considerable attention, the Swedish forestry periodical *Skogen*, for example, devoting an article to the Bureau and its activities.

19. Work with the Joint Bibliographical Committee secretariat at Rome on the preparation of the revised coverage list continued, and the revised and recast lists for 27 countries, including those of the United Kingdom, Canada, India and other members of the Commonwealth, were published by FAO, Rome, in two loose-leaf instalments.

20. This continued process of thorough reappraisal was largely responsible for the net reduction recorded above in our regular coverage list. Coverage in Spain, Yugoslavia, Macedonia, Slovenia and in the Caribbean has been substantially strengthened during the period, through the help of Correspondents.

21. *Pastures and Field Crops.* A compilation giving brief details of current agricultural research in Africa on annual field crops and grasslands was prepared for publication by the Bureau of Pastures and Field Crops. This was compiled from the answers to questionnaires sent out last year.

22. *Information and Identification Services.* The Institute of Entomology prepared a bibliography, at the request of the Department of Agriculture, Sierra Leone, of the insect pests of agricultural crops in that Territory.

23. There has been a 25 per cent. increase in the number of specimens sent to the Mycological Institute Herbarium, mainly from Commonwealth countries, whilst the number of fungal cultures received has doubled since 1959.

24. An exhibit was prepared by the Herbarium and shown at the annual conversazione of the Institute of Biology held in London in June.

25. Assistance was given to the British Mycological Society in editing the revised edition of 'Common British Plant Diseases'.

26. Requests for information regarding biological control work continue to be numerous and many may develop later into definite projects for the Institute of Biological Control. Memoranda have been prepared on the previous efforts and present possibilities of biological control of the codling moth, *Carpocapsa pomonella*, and the potato-tuber moth, *Gnorimoschema operculella* (both by Dr. Lloyd), and the mahogany shoot borers, *Hypsipyla* spp. (by Dr. Bennett).

27. In addition, reviews of literature together with an assessment of biological control possibilities are being made at the request of Canada. The first three of these will deal with the European pine sawfly, *Neodiprion sertifer*, the pine shoot moth, *Rhyacionia buoliana* and the larch sawfly, *Pristophora erichsonii*. A summary of the work carried out by the Institute in 1959 was produced in order to provide information on the current activities of the various stations.

28. Successful work reported during this financial year comprises:

(*a*) Successful establishment of parasites of San Jose scale, *Quadraspidiotus perniciosus*, in New Zealand. Both *Prospaltella perniciosi* and *Aphytis diaspidis* are established from material sent from the Indian Station.

(*b*) In Bermuda *Cryptolaemus montrouzieri* and *Azya luteipes* introduced from the West Indian Station against *Pulvinaria psidii* in 1956 and 1957 are well established and controlling the scale in some areas.

(*c*) *Azya trinitatis* and *Cryptognatha nodiceps* introduced from Trinidad into Jamaica in 1957 against the newly recorded coconut scale, *Aspidiotus destructor*, are established but it is uncertain as yet to what extent they are contributing to the control of the scale.

(*d*) In Bermuda the predacious snail, *Euglandina rosea*, obtained from Hawaii and introduced against the noxious snail, *Otala lutea*, is well established and it is thought that the pest is less abundant in areas where *Euglandina* occurs.

(*e*) In Bermuda, too, investigations on the possibilities of the biological control of the leaf hopper *Clastoptera undulata* have resulted in the successful introduction of the nymphal parasite *Carabunia myersi* from Jamaica. It is as yet too early to determine the value of this in controlling the pest.

(*f*) Work on the biological control of *Diatraea saccharalis* in Barbados continues; several strains of *Lixophaga diatraeae* have been liberated in large numbers and whilst as yet no control has been

achieved, recoveries of parasites from several areas is encouraging.

(*g*) The successful results achieved in Nevis through the introduction of *Cactoblastis cactorum* against *Opuntia* spp. were recorded last year. However, it might be added that the most noxious of the *Opuntia* spp., *O. triacantha*, is now under complete and spectacular control in Nevis and *Cactoblastis* has been introduced into Antigua and Montserrat.

(*h*) It has just been learned that *Agathis stigmatera*, a sugar-cane borer parasite sent from the West Indian Station to Mauritius in 1949-53, has been recovered in the field there. Although established it is doubtful if this species will be of economic importance.

(*i*) *Tetraeuaresta obscuriventris*, introduced from the West Indian Station in an attempt to control the weed *Elephantopus mollis*, is now extremely abundant but its effect on colonisation of the weed has not yet been determined.

29. The Bureau of Animal Breeding and Genetics received a request from the Animal Husbandry Research Division of the United States Department of Agriculture for information on the Australian Illawarra Shorthorn breed. This request arose from discussions on comparative heat tolerance of European breeds with this enquirer whilst he was in Edinburgh. The Bureau supplies not only references but information on performance and a description taken from one of the Australian agricultural journals.

30. The Statistician of the Ministry of Agriculture, Kenya, asked for information on shrinkage losses incurred by pigs in transit from farm to bacon factory. The Bureau was able to supply references and photostat copies of two reports, and put the enquirer in touch with a research worker at Cambridge. The Kenya delegate to the 1960 Review Conference mentioned this enquiry as one which provided useful information to his country.

31. The Indian Council of Agricultural Research asked for information on the domestication of the vicuna in Peru, its breeding habits, etc. The Bureau supplied a short note and list of references which showed that very little success had been achieved in domesticating this animal in South America.

32. The Director of the East African Tsetse and Trypanosomiasis Research Organisation in Uganda, discussed with the Director at Edinburgh possible sources of N'Dama cattle. This West African breed is tolerant of trypanosomiasis in its own environment but it has been fairly widely used outside its own home (Senegal) and herds have been established in the Congo.

33. A request was received from Tanganyika for information on the age of sexual maturity in rams, especially of hairy breeds of sheep, and the effects on growth and maturity of weaning at different ages. There is a dearth of information on this subject but the Bureau supplied a number of references to breeds other than the tropical hairy type of sheep.

34. (i) The Bureau of Animal Health dealt with a number of interesting enquiries:

(*a*) *Chronic Haematuria in Cattle.* This disease which occurs locally in many widely separated parts of the world has been known for many years but little or nothing is yet known about its causation. The areas in which it occurs are, generally speaking, places where the soil is poor and the vegetation coarse, places where plants such as bracken are common. It may be troublesome where new land is coming into cultivation and tends to die out as agriculture becomes more established and developed. The lesions are confined to the urinary bladder and are papillomatous or even pre-cancerous in nature. No infective agent seems to be involved. Some unknown toxic substance from the fodder excreted in the urine has been postulated as the cause. An intriguing suggestion from a Russian journal is that the disease may be associated with areas where rock formations have higher radioactivity than usual. It occurs, among other places, in parts of Australia, Canada, the Belgian Congo, Russia, India, Ireland and in Kenya from where the enquiry came. The only country in the Commonwealth where any planned research on the disease is being conducted at present appears to be Australia. The disease has resemblances to cancer of the bladder in man, an occupational disease which occurs frequently in men working on the manufacture of certain aromatic amines. The cause in man seems to be not the amines themselves but their metabolities excreted in the urine. The manufacture of one of these aromatic amines, 2-naphthaflamine, has ceased in Gt. Britain because of the hazard involved. Further work on the problem seems to be necessary.

(*b*) *Bovine Leptospirosis.* Although leptospires have been known to be an important cause of disease in man and in dogs for many years and the disease which they cause in man and dogs has been closely studied, it is only comparatively recently that they have been recognised as a cause of disease in cattle. Leptospirosis in cattle is today a very important disease in some parts of the world, particularly in the U.S.A. where it is one of the major infective diseases of cattle and of great economic importance. It is interesting to recall that the cause of the disease was first discovered by Russian workers and their work became known in the U.S.A. through abstracts in the *Veterinary Bulletin*. The first report on the occurrence of the disease in the U.S.A. was from E. Jungherr and in his original paper published in 1944 he acknowledges that he learned of the Russian work from abstracts in

the *Veterinary Bulletin*. There is now a very large literature on the disease as it occurs in the U.S.A. and an enquiry came from a firm in England with large interests in cattle ranches in Argentina.

(*c*) *Pea Hydrolysates for Preparation of Bacteriological Media*. In bacteriological laboratories throughout the world beef broth is one of the basic materials used in the preparation of media for the growth of bacterial cultures. In some Indian laboratories religious beliefs cause difficulties in the use of beef broth for this purpose. Some bacteriologists in India have sought to overcome this difficulty by preparing from vegetable sources products which could replace beef broth and have obtained some interesting results. An article in a Russian publication dealt with the use in media of hydrolysates made from peas and was the subject of an abstract in the *Veterinary Bulletin*. The abstract interested the workers in India who requested the Bureau to supply a full translation of the Russian article.

(*d*) *Tuberculin Testing*. Although in a number of countries the eradication of bovine tuberculosis by systematic testing and slaughter of reacting cattle has reached a very advanced stage there is little sign of a diminution of interest in the use and interpretation of the tuberculin test. The test has a high degree of accuracy but like all biological tests it is not 100 per cent accurate and difficulty arises from time to time in interpretation of the results. One difficulty is the non-specific reactions which occur in some healthy cattle which have become sensitized to tuberculin probably by contact with certain species of non-pathogenic mycobacteria. Non-specific reactions have occurred ever since tuberculin was first used for diagnosis of bovine tuberculosis. In the early stages of an eradication campaign when there is a high incidence of the disease in the cattle being tested the non-specific reactions are relatively unimportant, a nuisance rather than a problem. As eradication proceeds and the number of cattle which react to the test decreases, the non-specific reactions may constitute a high proportion of all reactions and so become relatively very important. When that stage is reached, as it has been in a number of countries, interest increases in the causation of these non-specific reactions and in methods which might be used to distinguish them from true reactions. These considerations accounted for two enquiries, one from Fiji and one from Ireland.

(*e*) *Fluorine Poisoning*. An enquiry from Ghana sought information on the possibility of poisoning of pigs by fumes containing fluorine from an aluminium smelting works which was projected in connection with the Volta river scheme.

(ii) Miscellaneous enquiries dealt with by other Bureaux:

(*a*) Of particular interest to the Bureau of Animal Nutrition was a request from a Professor of Surgery in this country for information on the diet of the people of New Zealand which might explain why peptic ulcer is much less common there than in Scotland.

(*b*) In connection with a general survey of Yaks in India, the Indian Council of Agricultural Research was supplied with an annotated bibliography on Yak's milk, yield and composition and notes on their feeding and management etc., by the Bureau of Dairy Science and Technology and other animal bureaux.

(c) Information on dairying education in this country was given to the Commonwealth Relations Office in response to an enquiry received by them from India.

(*d*) The Department of Agriculture in South Africa was provided with a detailed bibliography on the manufacture of rennet while another enquirer from South Africa was given detailed information on the amido-black method of milk protein determination.

(*e*) Australian research workers were supplied with varied information ranging from methods of detecting residues of sodium hypochlorite and Q.A.C. compounds in milk, to formulae for soft ice cream and the use of cultured milks in milk chocolate, while a number of extended abstracts, chiefly of Russian research papers, were sent to New Zealand research workers.

35. The Director, Forest Products Laboratory, Chittagong (E. Pakistan) was advised by the Forestry Bureau on developments in the use of radio-isotopes for estimating the penetration of preservatives into wood, for improving seed germinability and for genetic studies.

36. The Bureau of Plant Breeding and Genetics supplied comprehensive bibliographical references to the authorities responsible for compiling the new *Flora Europaea*. One of the results of this was a visit to the bureau by some of the authorities and later a letter in which they wrote as follows: "It occurred to us that the information available in your system is extremely useful, but it is not in our experience sufficiently widely known amongst taxonomists. We feel, therefore, that it would be well worthwhile publishing a note in some international journal, such as *Taxon*, in which these facilities are explained. . . . we should like to know whether these facilities could be extended to include other countries, if necessary with the payment of an appropriate fee".

(*a*) A lecturer in Crop Production in Salisbury, S. Rhodesia, was supplied with full bibliographies on the physiology of hybrid vigour, and a lecturer

in Agricultural Botany at Sehore M.P. India, with details of pollen germination experiments extracted from works published in Russian, Bulgarian, Spanish and Japanese.

(*b*) Arrangements were made on behalf of the Gatooma Research Station, Southern Rhodesia, for seed of cotton and other plants to be subjected to irradiation, for the induction of mutations, at the Radiation Laboratory of the U.K. Atomic Energy Authority.

(*c*) Mr. A. I. Cherny, Scientific Secretary, Department of Scientific Methods of Information and Documentation, All-Union Institute of Scientific and Technical Information, Academy of Science of U.S.S.R., visited the Bureau of Plant Breeding and Genetics on 8th March, 1961, to become acquainted with the organisation of the work of the bureau, in particular in connection with the use of mechanised equipment and punched card machinery. He declared himself particularly impressed with this and with the wide range of languages covered by what he regarded as a very small staff for the work performed.

(*d*) A chapter on Seed Improvement by Plant Breeding was contributed by the Director, at the request of the Central Office of Information, for inclusion in a publication on U.K. research in agriculture, in connection with International Seed Year.

RECOMMENDATIONS OF THE 1955 REVIEW CONFERENCE

37. Action taken on these recommendations up to June, 1960 is noted in Appendix I of the Report of Proceedings of the Review Conference, 1960. Action during the rest of the year is reported below, the numerals being those of the recommendations summarised in paragraph 21 of the 1955 Review Conference report. In the interests of economy, the recommendations are not quoted and the following notes should be read together with the action previously reported.

38. Some of the recommendations made in 1955 have been modified by those made in 1960, notably recommendations 14, 24 and 35 of the 1955 Conference.

(*a*) *Recommendation* (*4*). The agreement with the Inter-African Phytosanitary Commission, whereby the two London institutes act as centres of information to the Commission for entomology and plant pathology under the Phytosanitary Convention for Africa South of the Sahara, in consideration of a sum of £3,500 for their services, was signed by the Secretary on behalf of Council in May, 1960.

Due mainly to the Director's efforts, international co-operation with other institutes and entomologists interested in Biological Control continues very satisfactorily.

At the request of the Rockefeller Foundation, C.A.B. are assisting in the preparation of a Rice Bibliography.

(*b*) *Recommendation* (*8*) (*a*). Certain Official Correspondents are reported to have visited the Bureaux during the year.

(*c*) *Recommendation* (*10*). The four last appointed members on the staff of the Forestry Bureau—all of the 'Arts graduate' category—attended regular lectures at the Imperial Forestry Institute and had an afternoon of practical instruction in forest management in Wytham Woods under the guidance of an Institute specialist.

(*d*) *Recommendation* (*18*). Further progress was made in the reorganisation and streamlining of the production of annual indexes. For instance, the index to *Dairy Science Abstracts*, Volume 22 (1960), was again published in good time, early February, 1961. The volume index for the 1960 volume of the *Veterinary Bulletin* was issued in January, 1961.

(*e*) *Recommendation* (*21*). The Bureau of Animal Health and the Bureau of Dairy Science and Technology between them accounted for most of the paid advertisements in C.A.B. journals.

(*f*) *Recommendation* (*35*) (*d*). The Bureau of Helminthology continued to assist in local surveys: nematodes in monkeys, rhinoceros, elephants and cattle in Kenya; nematodes in goats, cattle and beetles in Nigeria; large collection of helminth parasites from various antelope species, monkeys, reptiles, wild geese, insectivore, rhinoceros, civet cats, poultry, etc., in Northern Rhodesia; nematodes from onions and sugarcane in Mauritius; schistosomes from bovines in Southern Rhodesia; filariids from *Tetrao urogallus* in Norway; bladderworms from goats in Liberia.

THE REVIEW CONFERENCE OF 1960

39. The Review Conference was held at The Church House, Westminster. The Conference was opened by Mr. Joseph Godber, M.P., Parliamentary Secretary, Ministry of Agriculture, Fisheries and Food, United Kingdom, on the 24th August and concluded on the 29th September, 1960.

40. Before closing the Conference, the Chairman, Sir William Slater, gave a farewell address to the retiring Secretary of C.A.B., Sir Herbert Howard, and presented him and Lady Howard, on behalf of the assembled delegates and the people of the Commonwealth who had generously contributed towards it, with a canteen of silver engraved with Sir Herbert's crest. His humorous reply was characteristic of him and so too was his gladiatorial salute.

41. The delegates made tours of inspection to the institutes and bureaux in the United Kingdom during the Conference period. All member countries were represented both at the Conference and on the tours. The Republic of Ireland also sent delegates, but the Republic of the Sudan did not participate.

42. By courtesy of the Government of the United Kingdom, a full report of the proceedings was published by Her Majesty's Stationery Office on the 17th April, 1961, as Command Paper 1322. Treasury stenographers made a verbatim record of the plenary sessions.

43. The proceedings contain a summary of the conclusions and recommendations of the Conference, the first of which is reproduced in the Preface to this report.

44. Advance action has been taken or is continuing on recommendations 23, 26(*a*), 26(*b*), 33(*a*), 33(*b*), 33(*c*), 36, 41, 45, 46, 50, 51, 52, 56, 58, 61, 64, 65, 71, 72, 73, 83, 85(*d*), 87, 88, 89. The action taken on these and other recommendations will be reported in the next annual report. The numbers given are those of the summarised recommendations in paragraph 20 of the 1960 Review Conference report.

MEMBERSHIP OF THE EXECUTIVE COUNCIL

45. It fell to Mr. A. Perera, Member for Ceylon and Chairman of the Executive Council, to give the welcoming address at the opening of the Review Conference at the Church House on 24th August, 1960.

46. Mr. C. Kemal Reheem, Member for Pakistan, succeeded Mr. Perera as Chairman, and Dr. V. Armstrong succeeded Mr. Reheem as Vice-Chairman, with effect from the 187th Council Meeting on 12th October, 1960.

47. With the advent of new members, Council felt that the time was opportune to reconsider the existing rota for succession to the Chair but the matter was still pending at the end of the year.

48. Dr. A. M. D'Rozario was nominated as India's representative on the Executive Council in place of Mr. S. Krishnamurti as from 1st December, 1960.

49. Mr. W. A. C. Mathieson was nominated as representative of the Colonial Territories in place of Mr. C. E. Lambert as from 12th December, 1960.

50. Mr. Lambert had served on Council since December, 1952, and had been Vice-Chairman and Chairman and as a Member of Council he had also served as chairman of the Appointments Committee. His retirement from the public service deprived Council of his wise counsels and his intimate knowledge of C.A.B. affairs.

51. Mr. J. D. de Silva, member for the Federation of Malaya, returned to Malaya and was succeeded by Mr. Yusoff bin Zainal in January, 1961. Nominations for Ghana (in place of Mr. Vanderpuye) and for the Federation of Nigeria were awaited at the end of the year.

LIAISON OFFICERS

52. Owing to pressure of other work, Mr. H. L. Trueman relinquished his duties as C.A.B. Liaison Officer in Canada from 28th February, 1961, and Dr. G. M. Carman succeeded him.

53. Mr. Trueman served as C.A.B. Liaison Officer from May, 1946 and played a major part in fostering the growth, development and morale of this organisation. He attended four quinquennial Review Conferences and was head of the Canadian delegation both in 1955 and 1960. Always a staunch friend and well-wisher of C.A.B., he did much to maintain cordial relations between C.A.B. and the Government of Canada. It was through his advice and assistance, willingly given at all times, that the Institute of Biological Control grew and prospered at its Canadian headquarters.

54. C.A.B. suffered another severe loss during the year in the retirement, for reasons of health, of Mr. N. A. Marris who had served as Liaison Officer in New Zealand from March, 1948. He too was a very good friend to C.A.B. and a most efficient link between the Secretary and the New Zealand authorities.

55. Mr. V. Shankar was appointed Liaison Officer in India in place of Dr. M. S. Randhawa, who led the Indian Delegation to the 1960 Review Conference.

STAFF CHANGES

56. *Secretary.* Sir Herbert Howard retired on 31st December, 1960. He had proved a worthy successor to Sir David Chadwick and made a marked personal contribution to the success of the organisation.

57. The impending vacancy was widely advertised throughout the Commonwealth and the response, in a Review Conference year, was overwhelming; over 130 applications were received and summarised in the secretariat and a multitude of references obtained for the scrutiny of the screening committee appointed by Council. The screening committee, after two meetings, reduced the names to a short list of seven. The Executive Council then met on the 18th May, 1960, assisted by the Chairman of the C.A.B. Scientific Advisory Committee, Professor Sir Joseph Hutchinson, and again on the 24th May, 1960, to interview the candidates on the short list. As a result, the post was offered to and accepted by Mr. A. E. Trotman, C.M.G., who was on the point of retiring from the post of Minister for Natural Resources, Tanganyika.

58. Appointed Officer on Special Duty from 15th August, 1960, Mr. Trotman had the benefit of a four-and-a-half-month overlap to acquire some knowledge of the post and its manifold problems and the privilege of attending the Review Conference and participating in the inspection tours. He then assumed charge as Secretary on 1st January, 1961.

59. Mr. Trotman was knighted in the New Year honours but did not live to receive the accolade. He died of coronary thrombosis on the evening of the 14th January, mourned alike by his family and friends, Executive Council and staff.

60. Council met under these tragic circumstances on 18th January to pay tribute to Mr. Trotman's memory and to consider the appointment of a new Secretary. They met again on 8th February and 14th February and decided to offer the post to Sir Thomas Scrivenor, C.M.G., recently retired from the post of Deputy High Commissioner for Basutoland, the Bechuanaland Protectorate and Swaziland.

61. Sir Thomas took over as Secretary soon after the close of the year, the duties of the post having been ably discharged in the interim period, as in happier circumstances in the past, by the Acting Secretary, Mr. E. L. Hay, M.B.E.

62. *Consultant Directors.* There was no change among the existing Consultant Directors but it is sad to recall the death on 16th September, 1960, of Sir George Stapledon at the age of 77. Sir George was the first consultant to the Bureau of Plant Genetics (Herbage Plants) as it was then called.

63. *Directors.* Dr. J. M. Watson resigned the post of Director, Bureau of Helminthology, on 21st December, 1960, and Dr. S. M. Willmott was appointed Acting Director till further notice. The question of a permanent incumbent was postponed pending the findings of the committee of experts appointed by Council to enquire into the future of the Bureau and of its taxonomic unit.

64. *Assistant Directors.* Major H. A. Dade retired in September, 1960, and Dr. G. C. Ainsworth was appointed Assistant Director, Commonwealth Mycological Institute, with effect from 1st April, 1961.

65. Mr. F. W. Sellers, formerly Assistant Director, Institute of Biological Control, died in Bangkok during the year.

66. Mr. P. W. Swire, Assistant Director, Bureau of Animal Breeding and Genetics, resigned as from 1st March, 1961.

67. *Distinguished Octogenarian.* Commenting on Professor Leiper's temporary part-time appointment as consultant helminthologist to the Bureau of Helminthology from 6th February, 1961, *The Times* in its issue of 18th April featured him as "Man in the News" and said: "A new appointment at 79 brings no surprise to friends of Professor Robert T. Leiper, F.R.S., Britain's first and foremost helminthologist, whose 60 years of study of the effects of parasitic worms in man, beasts and fish have often led scientific opinion throughout the world.

"Yesterday, his eightieth birthday, Professor Leiper, who was for 30 years director of the Commonwealth Bureau of Helminthology until he retired in 1958 and has now been given the new post of consultant helminthologist to the bureau, recalled that when he first started his work, Sir Patrick Manson made him promise to devote his life to the subject".

Professor Leiper abundantly honoured that promise and his advice and assistance on recall have been invaluable in tiding the Bureau over a difficult period.

VISITS OVERSEAS

68. After retirement from the post of Secretary, Sir Herbert Howard undertook a sales tour of the United States with a view to sounding the American market for C.A.B. publications. On return, he submitted a report of the tour which lasted from the 7th January to the 23rd February, 1961, and appeared in person to discuss it with Council on 23rd March. Earlier, on the 8th March, Sir Herbert

was present at an informal discussion which certain Council members had with Mr. Altson of Kraus Periodicals Inc. on a proposition for the sale of C.A.B. publications in America. Mr. Altson was an influential member of the American book trade whom Sir Herbert had met on his visit to the U.S.A.

69. Mr. E. O. Pearson, Director, Institute of Entomology, visited the Sudan Republic as a member of their Advisory Committee on Agriculture in January, 1961, and Tanganyika Territory and the Federation of Rhodesia and Nyasaland in February-March, 1961 to advise on entomological research in those territories.

70. Mr. W. H. Potts attended a meeting of the International Scientific Committee on Trypanosomiasis Research in Nigeria in July, 1960.

71. At the request of the Sugar Industry Research Board of Mauritius, Dr. Hayward visited Mauritius, Réunion, Madagascar and Natal to investigate the breakdown of varieties of sugarcane previously resistant to gumming disease due to *Xanthomonas vasculorum*. He spent two months examining cane fields and collected much material of gumming disease, red stripe, and mottled stripe for examination at the Institute. There are indications that a new strain of *X. vasculorum* has arisen.

72. Dr. Simmonds, Director, Institute of Biological Control, was on tour in Africa from 15th March to 1st July, 1960, covering Tanganyika, Kenya, Southern Rhodesia, Union of South Africa, Basutoland, Swaziland, Nigeria, Southern Cameroons, Sierra Leone, Gambia; from the 6th March to 11th April, 1961, he was in Trinidad, Barbados, Jamaica, Bahamas. He also paid visits to the European and West Indian Stations. Mr. Bennett visited Bermuda, Barbados, Jamaica, St. Kitts-Nevis and the U.S.A.; Dr. Carl spent from April-December, 1960, at the Pakistan Station and paid a short visit to the Indian Station; Dr. Lloyd left in January, 1961 to carry out several assignments in South America.

73. Officers of the European Station covered a wide area of Europe during the course of their investigations.

74. The Fifth International Congress of Nutrition held in Washington, D.C., from 1st to 7th September, 1960, was attended by Dr. Harvey, Director, Bureau of Animal Nutrition.

75. Mr. Ford Robertson, Director, Forestry Bureau, toured the Caribbean area from 18th July to 14th August, visiting the forest departments of Jamaica, Trinidad, Br. Guiana, and Br. Honduras, and attended the Fifth World Forestry Congress at Seattle, U.S.A., 29th August to 16th September, 1960, participating in the pre-Congress tour of the Pacific coast.

76. Mr. Skidmore, Assistant Director, Bureau of Pastures and Field Crops, visited Ghana, Nigeria, and F.A.O., Rome, during October and November, 1960.

77. Mr. Jacks, Director, Bureau of Soils, attended the Seventh International Congress of Soil Science at Madison, U.S.A. and took part in a subsequent excursion to San Francisco from 15th August to 7th September. Prior to the Soil Congress, he made an eight-week tour of Canada from Newfoundland to British Columbia and back to Winnipeg.

ATTENDANCE AT CONFERENCES AND COMMITTEES

78. Sir Herbert Howard attended a seminar and conference on agricultural documentation at Stuttgart-Hohenheim from the 20th to the 23rd April, 1960. Dr. Harvey, Director, Bureau of Animal Nutrition, and Mr. Jacks, Director, Bureau of Soils, were also permitted to attend.

79. The Seventh Commonwealth Entomological Conference, organised by the Institute of Entomology, was held in London from 6th to 15th July, 1960. It was attended by 56 delegates and observers representing 20 Commonwealth countries, Eire and the United Nations. Thirty-one papers were presented at the Open Meetings, attendance at which approached 200.

80. Mr. E. O. Pearson, Director, Institute of Entomology, Mr. G. E. J. Nixon and Mr. G. J. Kerrich represented the Institute at the Eleventh International Congress of Entomology at Vienna in August, 1960 and the last-named at a Colloquium of the Commission Internationale du Lutte Biologique in Zurich, preceding the Congress.

81. The Fifth Annual Meeting of the Inter-African Phytosanitary Commission held in London from 10th to 12th October was attended by Mr. E. O. Pearson and Mr. G. S. Cotterell.

82. Mr. E. O. Pearson served as a member of the Committee for Colonial Agricultural, Animal Health and Forestry Research, the Colonial Pesticides Research Committee, the British Standard Institution Technical Committee on the Nomenclature of Insecticides, the Advisory Committee on Anti-Locust Research, the Scientific Advisory Committee of the Empire Cotton Growing Corporation, the Advisory Committee on Agriculture in the Sudan, and the Council of the Royal Entomological Society of London, of which he was a Vice-President.

83. Mr. G. J. Kerrich served as Honorary Treasurer of the Systematics Association and as a

member of Council of the British Trust for Entomology.

84. Mr. W. H. Potts served as a member of the Tsetse Fly and Trypanosomiasis Committee, and as Editor of the Royal Entomological Society of London.

85. In July, 1960, the Sixth Commonwealth Mycological Conference was held in London at the London School of Hygiene and Tropical Medicine. Thirty-three delegates from Commonwealth governments and overseas research institutions attended as well as an observer from F.A.O. Numerous scientists from universities and agricultural centres in the United Kingdom, numbering over 100 at some sessions, were also present by invitation.

86. During October, 1960, Mr. Altson attended the Fifth Meeting of the Inter-African Phytosanitary Commission in London and the Director, Dr. Hopkins, with Dr. Ainsworth, attended the annual informal meeting arranged by the Medical Mycology Committee of the Medical Research Council in Birmingham.

87. In company with Sir Herbert Howard, Dr. Hopkins attended a meeting of the Industrial Grants Committee to put the case for an increase in the D.S.I.R. grant to the Culture Collection.

88. Dr. Hopkins continued to serve on the Colonial Agricultural and Forestry Research Committee, Colonial Pesticides Research Committee, British Standards Pesticide Committee, London Advisory Committee for Rubber Research, and the Medical Mycology Committee of the Medical Research Council.

89. Miss Waterhouse was elected President of the British Mycological Society for 1961.

90. Dr. Ainsworth was elected to the committee of the Society of General Microbiology.

91. Drs. Ellis and Booth and Miss Waterhouse attended the Second European Mycological Congress in Czechoslovakia in August, 1960 and visited mycological herbaria housing classical collections of fungi.

92. Dr. Simmonds, Director, Institute of Biological Control, and Drs. Mesnil, Lloyd and Pschorn-Walcher attended the Eleventh International Congress of Entomology in Vienna in August, 1960.

93. Dr. Simmonds attended in Nairobi, Kenya, on 9th April, 1960, a meeting of the committee formed to consider the establishment of an East African Station of the Institute.

94. Mr. Crawford, Director, Bureau of Animal Health, attended the F.A.O. International Conference on Veterinary Education, 27th-29th April, (London); the eighth International Grassland Congress, 15th, 19th and 20th July, (Reading); the Second International Bioclimatological Congress, 9th September, at which he read a paper on "Diseases of Animals as Influenced by Weather", (London); and the British Veterinary Association Conference on Hypomagnasaemia, 23rd and 24th November, 1960 (London).

95. Mr. Mack, Assistant Director, attended the British Veterinary Association Annual Congress at Glasgow, 28th August to 3rd September, where the publications of the Bureau were exhibited.

96. Meetings in connection with the work on the Classification of Knowledge of Nutrition were held in Vienna between 22nd and 25th May and in Karlsruhe from 13th to 14th October. The first was attended by Dr. Duncan, Assistant Director, and Dr. Leitch, and the second by Dr. Leitch.

97. Mr. Mann, Director, Bureau of Dairy Science and Technology, continued to serve as a member of a Committee of the International Dairy Federation dealing with dairy terminology. A meeting of the Committee took place in Paris, in November, 1960.

98. Mr. Ford Robertson, Director, Forestry Bureau, attended the Standing Committee on British Commonwealth Forestry, the Joint FAO/IUFRO Committee on Bibliography (informal meetings), and the Planning Committee of the Empire Forestry Association.

99. Miss Napier of the Bureau of Horticulture & Plantation Crops was given leave to stay six months at a horticultural research station in Sweden to learn the language and to get a clearer picture of horticultural research in Scandinavia. She returned to the Bureau on 1st October, 1960.

100. Mr. Hill and Mr. Skidmore, Director and Assistant Director respectively of the Bureau of Pastures and Field Crops, and some members of the staff attended the Eighth International Grassland Congress, Reading, in July, 1960. The exhibition of C.A.B. publications organized by the Bureau at the International Grassland Congress was a success, judging by the interest shown by many delegates. The Bureau of Animal Nutrition was also represented at the Conference by Mr. Bell and Mr. Hepburn.

101. Dr. Hudson, Director, Bureau of Plant Breeding and Genetics, attended meetings of the International Commission for the Nomenclature of Cultivated Plants held at the Botanic Gardens, Cambridge, from 3rd to 6th June, 1960.

102. Dr. Hudson continued to serve as Chairman of the Library sub-Committee of the Faculty Board of Agriculture of the University of Cambridge.

103. The Abstracting Services Consultative Committee sponsored by the Royal Society of which Dr. Hudson was a member under the chairmanship of Sir Herbert Howard, was dissolved in November, 1960, though provision was made for *ad hoc* meetings when occasion demanded.

VISITS TO INSTITUTES AND BUREAUX BY OVERSEAS SCIENTISTS

104. Delegates to the C.A.B. Review Conference visited all the institutes and bureaux in the United Kingdom and delegates to the Seventh Commonwealth Entomological Conference and the Sixth Commonwealth Mycological Conference visited the Institutes respectively concerned.

105. A number of overseas scientists also visited the headquarters of the Institute of Biological Control in Ottawa and the outlying Stations during the year. In addition, a dozen or so Indian and Pakistani entomologists spent short periods at the various Stations training in techniques of parasite breeding. An officer of the Coconut Research Institute of Ceylon obtained similar training at the Indian Station.

106. Two short documentation courses were held at the Forestry Bureau, one in November, 1960, attended by seven officers (from British Guiana, India, Kenya, N. Rhodesia, Pakistan, Sierra Leone, and Tanganyika) and one in February attended by six officers (two from India and one each from Mauritius, Nigeria, Nyasaland and Trinidad) and by a Mr. E. Porte, graduate of the College of Forestry, Monrovia, Liberia, who was accepted for a year's training at the Forestry Institute and Bureau on a British Council scholarship.

107. Special training in the use of the Oxford Decimal Classification was given to Mr. Porte of Liberia, to Mrs. Irena Rowinski, Assistant Librarian in the Forestry Branch, Department of Northern Affairs and National Resources, Ottawa, and to M. R. Chimbault, Centre Technique Forestier Tropical, Nogent-sur-Marne.

108. Other distinguished visitors included:

Dr. J. de Alba, Costa Rica; Dr. G. N. Bhatia, India; Dr. A. V. Bogdan, Kenya; Prof. N. S. Borkhsenius, U.S.S.R.; Prof. M. Cárdenas, Bolivia; Mr. A. I. Cherny, Academy of Sciences, U.S.S.R.; Dr. B. G. Christidis, Greece; Dr. R. L. Cuany, Costa Rica; Dr. and Mrs. J. A. Dinnik, Kenya; Mr. Grahame Edgar, Australia; Prof. E. B. Edney, Rhodesia; Dr. S. Frauendorfer, Documentalist, Vienna; Dr. C. H. Goulden, Assistant Deputy Minister (Research), Department of Agriculture, Canada; Dr. H. Hedayar, Ministry of Health, Teheran, Persia; Dr. S. R. Hermosura, Philippines; Mr. C. R. Kelly, Member of the Australian Federal Parliament; Dr. O. Kóksal, School of Hygiene, Ankara, Turkey; Professor H. F. Kushner, U.S.S.R.; Dr. W. H. R. Lumsden, Uganda; Mr. K. L. Mehra, Indian Agricultural Research Institute, India; Mr. D. C. Menakaya, Eastern Nigeria; Dr. F. Mohrhardt, U.S.D.A.; Dr. R. L. Steyaert, Belgium; Prof. Krahl Urban, Hann. Münden; Mr. A. W. Waitts, Nigeria; Dr. P. O. Wiehe, Mauritius; Dr. S. G. Wilson, Nigeria.

PUBLICATIONS

109. The receipts from sales of publications have always been collected separately by the institutes for their respective publications, and by the Bureau of Animal Nutrition for the journal *Nutrition Abstracts and Reviews*. Central Sales deals with the sales of publications for headquarters, for all the other bureaux and for the Occasional Publications of the Bureau of Animal Nutrition. The four sets of receipts have always been shown separately in annual reports. From paragraph 110 it will be seen that total receipts from sales of publications for 1960-61 amounted to £93,437 as against the 1959-60 figure of £89,505.

110. Receipts from sales of publications over the last seven years have been as follows:

	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
	£	£	£	£	£	£	£
Commonwealth Institute of Entomology	10,334	11,433	15,582	14,144	14,630	14,801	16,489
Commonwealth Mycological Institute	6,833	6,820	9,438	10,781	11,471	11,770	11,655
Nutrition Abstracts and Reviews	6,972	8,428	9,928	9,582	11,856	11,967	12,130
The Bureaux	30,252	31,041	40,868	45,018	47,005	50,967	53,163
TOTAL	54,391	57,722	75,816	79,525	84,962	89,505	93,437

NOTE: The prices of journals were raised for the 1957 volumes.

111. Expenditure on production of publications for the bureaux (excluding *Nutrition Abstracts and Reviews* and the Institutes) amounted to £42,720 during the year as against £41,223 for the preceding year. Cash collected during the year was £53,163 thus giving a surplus of £10,443 of revenue over expenditure. This surplus and the rise in revenue of £2,196 resulted from an increase in subscriptions to the abstract journals and a continuing demand for the back volumes of those journals. It must be repeated that these calculations are for the publications dealt with by Central Sales and do not include the figures for *Nutrition Abstracts and Reviews* or the publications of the Institutes.

112. *Reprinting Unit.* This unit was established at Farnham House during 1957, reference paragraph 21 of the 29th Annual Report. This unit uses Xerography (an electrical reproduction process for making paper and metal offset duplicating masters) and offset litho equipment. During the year *Veterinary Reviews and Annotations, Volume* 6, occasional publications and reports and papers totalling 1,918 pages were printed from typescript prepared by Head Office, the Institutes and Bureaux. In addition, approximately 11,036 pages of back volumes of journals and occasional publications were reprinted.

113. The sales analysis, that is, the analysis of the actual invoices sent out during the year is shown in the table below. For comparison, figures are given for seven years. Only the publications dealt with by Central Sales have been shown in this way and earlier figures are intended to show the general trend.

	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
	£	£	£	£	£	£	£
Animal Breeding and Genetics	2,934	2,625	3,145	3,706	4,795	4,551	4,490
Animal Health	5,014	5,781	6,963	8,108	8,126	9,159	8,830
Animal Nutrition	51	41	628	513	288	436	396
Dairy Science and Technology	2,388	2,727	5,107	3,972	5,431	5,938	5,647
Forestry	2,939	3,274	5,180	5,087	5,913	5,667	6,362
Helminthology	1,621	1,866	2,266	3,174	2,765	4,491	3,940
Horticulture and Plantation Crops	3,343	3,541	4,686	5,036	5,138	5,357	5,527
Pastures and Field Crops	4,083	3,916	4,787	4,830	4,573	5,158	4,905
Plant Breeding and Genetics	2,929	3,718	4,320	4,242	4,224	5,378	5,151
Soils	3,648	4,005	4,683	5,468	5,183	6,099	6,394
Headquarters	106	88	329	258	115	276	266
TOTAL	29,056	31,582	42,094	44,394	46,551	52,510	51,908

The increases and decreases from year to year in the sales of publications of the individual bureaux are largely due to the incidence of the issue of occasional publications. If a bureau issues two or three occasional publications during one year and none the following year there will be a slight decrease in sales unless there has been a very large increase in subscriptions to its abstract journal.

114. The above table relates to sales and takes no account of copies distributed under the quota system or free. Under the quota system copies of the 1960 volumes of the journals to the value of £9,022 were sent to countries of the Commonwealth and other contributing countries. In addition, journals to the value of £1,403 were sent free and as exchange to Commonwealth countries and to the value of £3,212 to foreign countries.

The total value of copies distributed under the quota, free and exchange was £13,637.

Corresponding figures for 1959 were quota £9,043, free and exchange to Commonwealth countries, £1,590, and to foreign countries £3,275, total value £13,908.

In paragraph 111 it is said that receipts from sales during the year showed an excess over the direct costs of printing, distribution and paper, but if the very great value of these various free copies is added to the receipts the total comes to far more than the direct cost of production.

115. In addition a further 102 volumes of *Agricultural and Horticultural Engineering Abstracts* and 159 copies of *World Agricultural Economics and Rural Sociology Abstracts* were distributed under the quota system by arrangement with the publishers.

116. The numbers on the mailing lists for the 1960 volumes of all journals were as follows:

	Volumes supplied under quota system	Other Volumes Supplied free	Subscriptions	Total
British Commonwealth, the Republic of the Sudan and the Republic of Ireland	2,732	387	6,999	10,118
Other countries	—	964	12,093	13,057
TOTAL	2,732	1,351	19,092	23,175

117. The subscriptions to the *Bulletin of Entomological Research* and the fourteen abstract journals only, detailed in paragraph 119, increased in number during the year from 17,412 to 18,127. This is analysed in the following table:

Agency	1959	1960	Increase	Percentage Increase
Institute of Entomology (3 journals)	3,317	3,409	92	2·8
Mycological Institute (1 journal)	1,448	1,535	87	6·0
Nutrition Abstracts and Reviews (1 journal)	1,784	1,823	39	2·2
Bureaux (10 journals only)	10,863	11,360	497	4·6
TOTALS	17,412	18,127	715	4·1

118. Action taken to increase the sales of journals and occasional publications was as follows:

(i) Central Sales now distribute twice a year a Publication List of the Commonwealth Agricultural Bureaux to selected addresses. Some 6,000 of the April, 1960, list were despatched and 6,000 of the October, 1960, list. Leaflets describing new Occasional Publications and cyclostyled forms showing recent publications were inserted in the journals in considerable numbers. Interested people were given specimen copies of journals and, in some cases, extra copies of certain parts of journals were printed to be circulated to potential purchasers.

(ii) Publications were shown in book exhibitions organised by scientific organizations or associations of booksellers. During the year, C.A.B. publications were displayed at book exhibitions in London, Reading, Stuttgart, Milan, Helsinki, Zagreb, Plovdiv, Seattle, Osaka and Tokyo.

(iii) C.A.B. Publications were also brought to the notice of scientists and the public generally by advertisements either paid for or exchanged with other scientific journals.

(iv) The annual report is sold and is also widely distributed free, thus permitting many persons to acquaint themselves with the work of C.A.B. if they so desire.

119. During 1960 the following volumes of the *Bulletin of Entomological Research* and the fourteen abstract journals were issued:

Bulletin of Entomological Research, Vol. 51
Review of Applied Entomology, Series A, Vol. 48
Review of Applied Entomology, Series B, Vol. 48
Review of Applied Mycology, Vol. 39
Nutrition Abstracts and Reviews, Vol. 30
Animal Breeding Abstracts, Vol. 28
Veterinary Bulletin, Vol. 30
Dairy Science Abstracts, Vol. 22
Forestry Abstracts, Vol. 21
Helminthological Abstracts, Vol. 29
Horticultural Abstracts, Vol. 30
Herbage Abstracts, Vol. 30
Field Crop Abstracts, Vol. 13
Plant Breeding Abstracts, Vol. 30
Soils and Fertilizers, Vol. 23

120. The publication year of all the above journals is the calendar year and the first part or parts of the 1961 volumes were issued by the 31st March, 1961, the end of the year under review.

Other periodical publications issued during the year were:

Distribution Maps of Insect Pests, Nos. 109-120	*Entomology*
Distribution Maps of Plant Diseases, Nos. 374-379	*Mycology*
Commonwealth Phytopathological News, Vol. 6, Parts 2-4 and Vol. 7, Part 1	*Mycology*
Bibliography of Systematic Mycology for 1959 and 1960	*Mycology*
Review of Medical and Veterinary Mycology, Vol. 3, Parts 8-12 and Vol. 4, Part 1	*Mycology*
Catalogue of the Culture Collection, (3rd Edition), Supplement 1	*Mycology*
Index Veterinarius, Vol. 27 (1959), Parts 3 and 4. Vol. 28 (1960), Parts 1 and 2	*Animal Health*
Veterinary Reviews and Annotations, Volume 6	*Animal Health*
Bibliography of Soil Science, Fertilizers and General Agronomy, 1956-1959	*Soils*

The following occasional publications were issued during the year:

Report of the Seventh Commonwealth Entomological Conference	*Entomology*
Mycological Papers, Nos. 76-79	*Mycology*

Ainsworth and Bisby's Dictionary of the Fungi (5th Edition) by G. C. Ainsworth	*Mycology*
Herb. I.M.I. Handbook, Methods in use at the Commonwealth Mycological Institute	*Mycology*
Review of the Biological Control of Insects and Weeds in Australia and Australian New Guinea, by F. Wilson	*Biological Control*
The Indigenous Livestock of Eastern and Southern Africa, by I. L. Mason and J. P. Maule	*Animal Breeding and Genetics*
Diet in Relation to Reproduction and Viability of the Young, Part 3, Pigs, by D. L. Duncan and G. A. Lodge	*Animal Nutrition*
The Soil under Shifting Condition, by P. H. Nye and D. J. Greenland	*Soils*

SUMMARIES OF THE ANNUAL REPORTS FOR 1960-61, BY DIRECTORS

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

121. *Conferences.* An important feature of the year was the Seventh Commonwealth Entomological Conference, convened under the auspices of the Commonwealth Agricultural Bureaux and organised by the Commonwealth Institute of Entomology, which was held in London from the 6th to the 15th July, 1960. It was attended by 56 delegates and observers, representing 20 Commonwealth countries and also the Republic of Ireland and the United Nations, and the open meetings, at which discussions covered most of the important fields of research in agricultural entomology, attracted, in addition, a large number of entomologists resident in or visiting the United Kingdom. The Conference considered fully the activities of the Institute and those of the Commonwealth Institute of Biological Control and its resulting recommendations were laid before the Commonwealth Agricultural Bureaux Review Conference that met later in the summer. The Report of the Conference (399 pp.) was issued in December, 1960, a fact which won favourable comment from a number of delegates, and contained, in addition to a full account of the Conference itself, reviews of work from 47 territories and organisations, giving an overall picture of developments in economic entomology within the Commonwealth during the six years 1954-59.

122. *Staff.* There were no changes in the staff of taxonomic specialists during the year. Amongst the abstracting and recording staff there were four new recruitments, but three resignations. The difficulty in attracting and retaining abstractors remains a source of anxiety and gravely hampers the Institute's work.

123. *Overseas visits.* The Director visited the Sudan Republic as a member of their Advisory Committee on Agriculture in January, 1961, and Tanganyika Territory and the Federation of Rhodesia and Nyasaland in February-March, 1961 to advise on entomological research in those territories. Mr. W. H. Potts attended a meeting of the International Scientific Committee on Trypanosomiasis in Nigeria in July, 1960. The Director, together with Mr. G. E. J. Nixon and Mr. G. J. Kerrich, attended the XIth International Congress of Entomology at Vienna in August, 1960, and the last-named attended a Colloquium of the Commission Internationale du Lutte Biologique at Zurich, preceding the Congress.

124. *Identification service.* The approximate number of specimens received for identification was 47,000, as compared with the abnormally high total of 90,500 in the previous year. They were received in 553 consignments (535 in 1959-60), sent by 272 (248) correspondents, representing the following regions: Africa, 77; America, 26; Asia, 71; Australasia and Oceania, 31; and Europe, 67. The 446 (401) lists of identifications sent out comprised 9,161 (7,551) names; the total of species identified included 3,334 from Africa, 598 from America, 2,899 from Asia, 1,803 from Australasia and Oceania, and 527 from Europe, and the territories from which they were sent included almost all members of the Commonwealth. Most specimens were returned after identification to the senders and the remaining 5,610 (6,152) were presented to the British Museum (Natural History). These included the types of 47 species, and specimens of a further 173 not previously represented in the Museum collection.

125. Twenty-six technical papers or monographs written by members of the staff were published during the year, and comprised 994 printed pages. These included a taxonomic study of the larvae of West African Simuliid flies, by Mr. R. W. Crosskey (74 pp.); a monograph of the immature stages of neotropical timber beetles (the third of a series of regional monographs on the Cerambyidae), by Mr. E. A. J. Duffy (327 pp.); the third part of a series of keys to the Ethiopian Tachinid flies, by the late Dr. F. I. van Emden (175 pp.); and a revision of the Melolonthid beetles

of the genus *Schizonycha* from Southern Africa, by Mr. R. D. Pope (219 pp.).

126. *The Review of Applied Entomology*, Series A. and B, Vol. 48 (1960) totalled 798 pages (exclusive of indexes) and contained 1,840 abstracts and titles, the corresponding figures for 1959 being 720 and 1,464. The increase in size (11 per cent) and in the number of abstracts (25 per cent) reflect the measures being taken to increase the coverage. Indexing has been hampered by staff illness, but during the year the indexes to Vol. 46, Ser. A (114 pp.) and Vol. 47, Ser. B (43 pp.) were issued, and the index to Vol. 47, Ser. A (115 pp.) appeared in April, 1961. The indexes to Vol. 48 (1960) are well advanced.

127. *The Bulletin of Entomological Research* Vol. 51 (1960) totalled 821 pages (excluding the index) and 18 plates, and contained 62 papers contributed by authors representing 22 countries. The four quarterly parts were issued in April, July and November, 1960 and January, 1961, and the index is in the press; that to Vol. 50 was issued with Vol. 51 pt. 2.

128. Twelve issues (Nos. 109-114 in June, and Nos. 115-120 in December, 1960) were made in the series *Distribution Maps of Pests*, the title of which has been modified, to accommodate mites, by dropping the term 'insects'.

129. *Occasional publications.* A new edition of *The Review of Applied Entomology: Serial Publications Examined* was issued free with the *Review* in April, 1960; the revised list has been restricted to publications received in the Institute library. The *Report of the Seventh Commonwealth Entomological Conference 6th-15th July* 1960 (399 pp., 50*s*.) was issued in December, 1960, less than six months after the Conference took place.

130. The *Zoological Record* part *Insecta* Vol. 95 (literature of 1958) was issued in July, 1960. It was the largest volume ever to be issued, both as regards number of pages (650) and number of papers recorded (4,521). Vol. 96 (literature of 1959) is in the press.

131. *Sales of publications.* The number of subscribers to all publications of the Institute increased, the figures for 1960 (with those for the previous year in brackets) being as follows:

Review of Applied Entomology Ser. A, 1,359 (1,336);

Review of Applied Entomology Ser. B, 1,060 (1,038);

Bulletin of Entomological Research, 990 (945).

132. *Distribution Maps of Pests*, 338 (336). In addition, 515 copies of Occasional Publications were sold during 1960. The net cash receipts during the financial year 1960-61 for all publications was £16,488. This is a record, being over £900 better than the Institute's previous best year. Sales of back numbers constituted an important part of this total, amounting to £2,169 in respect of the *Review* and £1,979 in respect of the *Bulletin*. The Institute's share of receipts from sales of the *Insecta* was £930, to which must be added the Zoological Society's contribution of £500. The latter figure, which was increased from £400 in the previous year, is to be still further increased to £700, in 1961, and the Institute's share of sales will rise from 30*s*. to 40*s*. per volume.

133. *Library.* Accessions during the year numbered 137 bound volumes (plus a further 67 which were re-allocated numbers from withdrawn volumes) and 1,363 pamphlets, making a total of 14,616 bound volumes and 50,167 pamphlets now in the library. Parts of 690 serial publications were received, of which 434 were from non-Commonwealth sources. The author catalogue is complete for monographs and separates. The entomological contents of 69 (88) volumes were catalogued during the year, 70·1 per cent. of the library stock of bound volumes now being catalogued on cards by authors. The subject index to monographs, comprising 2,358 cards, and the sheaf catalogue of serial and official publications are both up to date.

134. Daily use was made of the library by visitors and staff, although the number of loans dropped slightly, from 1,582 to 1,458. As usual, many subject and bibliographical enquiries from government departments, universities, research stations and commercial organisations, as well as from individual readers, were received and dealt with during the year. Microfilms or photocopies were obtained of 53 articles and extracts, for correspondents in seven Commonwealth and six foreign countries. Surplus publications were distributed to the Bureaux and various other institutions, and, as always, grateful thanks are due to those individuals and organisations who kindly donated publications to the library.

135. *Information service.* Enquiries for information, many arising out of the insect identification service, were numerous and varied. The most time-consuming involved the compilation of a bibliography of pests affecting agricultural crops in Sierra Leone, and the most unusual postulated tunnelling by Simuliid larvae as the cause of pitting of metal plates on ferry-boat hulls in African lakes. The insects were exculpated, but search for the real cause led along an unfamiliar path and disclosed a corrosion problem apparently common to most navigable lakes and rivers. Other topics included the use of blacklight traps for insect control, the control of grape phylloxera by soil insecticides, and the insect enemies of witchweed. The Institute

continued to assist the Inter-African Phyto-Sanitary Commission in providing information relating to phytosanitary precautions and procedures and to specific enquiries received by the Scientific Secretary.

136. *Colonial Pool of Entomologists.* Mr. E. S. Brown, of the Colonial Pool of Entomologists, continued his secondment to the Foreign Office, and at the beginning of 1960, the last year of his assignment, changed his headquarters from Beirut to Teheran. He concluded his field studies of the soun pest in December, 1960, and returned to the United Kingdom, where he is now preparing the results of his work for publication. Mr. C. R. Wallace's report on his assignment to St. Helena was issued by the Colonial Office as a mimeographed report (54 pp.) in June, 1960. It comprises a comprehensive account of the insect pests of crops and stock on the island, with recommendations for practicable control measures. Later in the year he was appointed to carry out a reconnaissance of the insects of real or potential economic importance in Sarawak, and in October, 1960 sailed to take up his duties. Dr. I. W. B. Nye returned to the United Kingdom from the Seychelles in May, 1960, on completion of his assignment in connection with the control of *Melittomma*; he has completed a report on the organisation of the campaign to treat the entire coconut-palm population of Mahê; this is understood to be progressing vigorously and with the approval and co-operation of the planters. Since taking vacation leave he has been engaged at the British Museum (Natural History) on a re-examination of the taxonomic position of the coffee-berry moth and other Lepidoptera of economic importance, pending his next overseas assignment. The results of his work in East Africa were issued by the Colonial Office in November, 1960, as *The Insect Pests of Graminaceous Crops in East Africa* (Colonial Research Studies, No. 31, 48 pp.).

137. Two members of the Colonial Termite Research Unit, Mr. W. V. Harris, Officer-in-charge, and Mr. W. A. Sands, were attached to the Institute throughout the year.

138. Fifty species of termites were named from the 171 tubes of specimens submitted during the year. These originated in Cyprus, Turkey, Bahrein, West Africa, Congo, East Africa, Rhodesia, Burma, Malaya, Sarawak, St. Helena, Trinidad and Venezuela. Over 5,000 specimens collected and named by the Unit have been added to the collections of the British Museum (Natural History), and many others have been obtained by exchange. An extensive collection obtained during the Unit's four years in West Africa is now being worked.

139. The small stock of living termites has been maintained and the usual distribution of *Zootermopsis* to University protozoology classes was made. One post-graduate student at London University is being supplied with living termites for experimental purposes.

140. Mr. Harris attended the Seventh Commonwealth Entomological Conference, London, and the XIth International Congress of Entomology, Vienna, as an official delegate. At the invitation of UNESCO he took part, in October, in a symposium, "Termites in the Humid Tropics", held in New Delhi and arranged jointly by UNESCO and the Zoological Survey of India. Lectures were given at the Building Research Station to their summer course for overseas engineers and architects, and at the Architectural Association's School of Architecture to students in the tropical department.

141. Visitors to the Unit during the year included Dr. Thomas E. Snyder (Washington), Dr. M. L. Roonwal (Calcutta), Dr. Hans Schmidt (Reinbek bei Hamburg) and Mr. T. Greaves (Canberra).

142. A variety of economic problems have been dealt with, including treatment for a ship infested by dry-wood termites in East Africa, specifications for site poisoning in building contracts for the Public Works Department in Nigeria, resistance of plastics to termite damage, and termite control in Services' installations in the Mediterranean area. A list of injurious termites liable to be imported into East Africa was prepared at the request of the Inter-African Phyto-Sanitary Commission, and one of the species listed was discovered there before the end of the year.

143. Five papers, dealing with the taxonomy, biology and control of termites were published by members of the Unit during the year.

144. It is a pleasure to record the thanks of the Institute to Dr. T. C. Morrison-Scott, the Director of the British Museum (Natural History) and to Dr. W. E. China, who retired from the post of Keeper of Entomology in February, 1961, and Mr. J. P. Doncaster, who succeeded him, for the facilities accorded to the members of the staff of the Institute who work in the Museum, and to acknowledge the continued close and friendly co-operation of the staff of the Department of Entomology.

COMMONWEALTH MYCOLOGICAL INSTITUTE

145. *General.* In September, 1960, Major H. A. Dade retired from the post of Assistant Director in charge of the Culture Collection after 25 years' service with the Institute. During this period he has become an acknowledged authority on industrial fungi, more especially the Mucorales and the genus

Aspergillus. His deep knowledge and sound advice will be greatly missed by both the staff of the Institute and his many Commonwealth colleagues. The vacancy has been filled by Miss Phyllis Stockdale formerly in charge of cultures at the London School of Hygiene and Tropical Medicine.

146. A number of overseas visitors have worked in the Herbarium, the Culture Collection, and bacteriology laboratory for varying periods of time, coming from Australia, Austria, Ghana, Holland, India, Israel, Nigeria, and South Africa. Accommodation has also been provided for visitors from research centres in Great Britain.

147. Parties of students, many from overseas Commonwealth territories, have again been received and shown the work of the Institute, with an introductory talk on common tropical plant diseases illustrated with coloured transparencies by the Director. They included students from Imperial College of Science and Technology, the Brunel and Chelsea Colleges of Technology, St. Paul's School, as well as Colombo Plan and British Council students and those taking part in the pesticide course organised by Fisons Ltd. at Cambridge.

148. *Sixth Commonwealth Mycological Conference*. The Conference was held in July, 1960 at the London School of Hygiene and Tropical Medicine.

Delegates from 18 countries of the Commonwealth attended together with a number of visitors by invitation, including an observer from F.A.O. A week was devoted to paper reading sessions, and visits were made to agricultural research centres in southern England. A whole day was devoted to an inspection of the working of the Institute, as a result of which a number of recommendations was made to the Executive Council. A report on the proceedings, containing the papers in full, has been prepared at the Institute for publication by photo-offset. This has caused some delay owing to shortage of clerical staff, but a considerable saving has been made on normal printing costs.

149. *Library*. Cataloguing of books held in various parts of the Institute has been completed and the Institute's holdings of its own publications have been reorganized and centralized in the Library. Subject slips are being made for all books and a prominent key to their arrangement has been prepared and hung in the reading room for easy reference.

Cataloguing of surplus duplicates has now been completed and lists circulated to C.A.B. institutions and other libraries for distribution or exchange.

Further progress has been made with binding but there is still a considerable backlog of important publications to be done. The following additions were made during the year: 50 books, 8 new journals filed and 3 on loan, 1,300 reprints, and 262 microfilms. *Total holdings* are 2,550 books, 608 journals filed, 54,400 reprints, and 3,008 microfilms.

150. *The Review of Applied Mycology*. Work of abstracting proceeded normally; 2960 abstracts have appeared in Vol. 39, and the complete copy of the annual index was sent to the press by the beginning of March.

In an endeavour to accelerate the issue of the annual index and to assist readers the author index for Vol. 39 was published in the December number.

In Vol. 40 (1961), commencing with the January number, subject headings have been inserted on each page for easy reference.

151. *The Review of Medical and Veterinary Mycology*. Vol. 3 was completed with the issue of the December, 1960, number in which the number of pages was increased from 32 to 48. The index to this volume is in an advanced state of preparation.

Vol. 4, commencing with the March, 1961 number, will have alternately 32 and 48 pages per part in order to cover the rapidly expanding literature.

152. *Index of Fungi*. Mr. Deighton, with the assistance of Mr. Sutton, continues to compile this ever expanding periodical. Vol. 2 (1950-59) was completed with the issue of part 20. The cumulative index for the whole volume has been typed and checking is proceeding.

Difficulties have been experienced in compiling the list of over 4,000 fungus names omitted from Petrak's lists, particularly those of medical fungi, and this has necessitated much literature research in the larger London libraries. As a consequence, the publication of this supplementary list may be delayed until after the end of 1961.

153. *Commonwealth Phytopathological News*. Vol. 6 was continued as heretofore and its issue was endorsed by the Commonwealth Mycological Conference but the C.A.B. Review Conference recommended that it should appear in another form. There appears to be a need for the kind of information included in this periodical for otherwise it would be unlikely to be published; but suggested modifications so far received by the Director are, for one reason or another, impracticable, and alternatives are being considered.

154. *Identification Service*. A marked increase in the number of specimens sent for identification has taken place, 5,041 (3,818 in 1959/60) having been received from the following Commonwealth countries: Australia, Bechuanaland, British Guiana, British Honduras, British Solomon Islands, Cameroons, Ceylon, Cyprus, Ghana, Hong Kong, India (154), Jamaica, Kenya (185), Malaya,

Mauritius (101), Nigeria (206), New Zealand, North Borneo (97), Northern Rhodesia, Nyasaland, Pakistan, Papua and New Guinea (86), South Africa, Southern Rhodesia, Tanganyika, Trinidad, Uganda, United Kingdom, and Zanzibar.

Identifications were also made of material from Angola, Belgian Congo, Belgium, Brazil, Czechoslovakia, Ecuador, Egypt, Republic of Ireland, Israel, Libya, Madagascar, Netherlands, New Guinea, New Caledonia, Norway, Portugal, the Republic of the Sudan, Switzerland, Thailand, Turkey and Venezuela.

Large collections of unnamed specimens have been received from Dr. S. D. Ahmad, Pakistan, and named specimens from Drs. G. B. Cummins and D. B. O. Savile.

The number of fungus cultures for identification received in the Herbarium was double that of 1959/60.

155. Records of important diseases include *Chloridium musae* and *Piricularia musae* on banana in the Cameroons; *Ramichloridium musae* on banana in Sierra Leone and the British Solomon Islands Protectorate; *Cladosporium colocasiae* on *Colocasia esculenta* in North Borneo, Sarawak and Mauritius; *Mycosphaerella alocasiae*, which seems to be quite common, *Cercospora fuliginea*, causing brown leaf mould of tomato, *Elsinoe fawcettii* on Citrus, *Cercospora koepkei*, *Leptosphaeria michotii* and *Glomerella tucumanensis* on sugarcane in the British Solomon Islands Protectorate; *Mycosphaerella musicola* on banana in Mauritius; *Fusarium oxysporum* on banana in Kenya; *Pseudoplea trifolii* prevalent in Northern Nigeria and numerous new records of the same fungus from Nyasaland, Sarawak, etc.; *Glomerella vanillae* again in the Seychelles.

156. Dr. Ellis continued his revisionary studies of Hyphomycetes and wrote a paper dealing with *Septosporium*, *Acrodictys* (new genus), *Balanium*, *Chalara*, and *Corynespora*, mostly from tropical countries. He published *Mycological Papers* Nos. 76, 'Dematiaceous Hyphomycetes. I' and *Mycological Paper* No. 79 'Dematiaceous Hyphomycetes. II'. He also did a major share of the identification work.

157. Mr. Deighton undertook many identifications, particularly those of *Cercospora* spp. and continued his studies of *Cercospora* and allied genera, and of West African fungi in general. He published Mycological Paper No. 78, 'African Fungi. I', and 'Article 59' in *Taxon*, **9**, 8, 1960. His work with the *Index of Fungi* is reported above.

158. Dr. Booth continued with identification of Pyrenomycetes and has made a more extensive study of the genus *Fusarium*. He has made over 200 identifications of cultures sent in during the last nine months of the year.

He published '*Leptosphaeria elaeidis* isolated from anthracnosed tissue of oil-palm seedlings' jointly with Dr. J. S. Robertson in *Trans. Brit. mycol. Soc.* **44**, 1961, and has had another paper '*Thielavia rugulosa* isolated from Dianthus roots', written jointly with Miss M. Ebben, accepted by that journal.

He is preparing a monograph on certain genera of the Eurotiales for publication.

159. Mr. Sutton has made revisionary studies of *Coryneum*, *Pestalotiopsis*, *Cryptostictis*, and related genera and has commenced investigations on the cultural differentiation of *Colletotrichum* on Gramineae.

He has written a *Mycological Paper* on *Pestalotiopsis* and assisted Mr. Deighton in the compilation of the *Index of Fungi*.

160. Mr. Laundon has continued the identification of rusts and Basidiomycetes in general and has commenced a detailed study of rusts occurring on *Acanthaceae*. He undertakes most of the photographic work for the Herbarium which is being used increasingly for record purposes.

161. Mr. Pirozynski undertook identification of the Microthyriales, Dothideales, Discomycetes and some Perisporiales, and has commenced a revision of *Gyrothrix*, *Circinotrichum*, and some Microthyriales.

He also assists in the preparation of the Distribution Maps of Plant Diseases.

162. Miss Waterhouse has continued her studies and identification of the Phycomycetes, particularly the genus *Phytophthora*. She has made arrangements with Dr. P. H. Gregory of Rothamsted Experimental Station for testing the possibility of producing a world key for *Phytophthora* by comparing species and characters by means of an electronic computer. Work is proceeding rapidly in the production of the necessary programme of data.

She has continued to give most of her time to editing the *Review of Applied Mycology*.

163. *Culture Collection*. The total number of cultures maintained was 3,129 (2,821 in 1960). New accessions totalled 338, while 30 were lost or discarded. Every opportunity is being taken to ask pathologists to send in cultures of pathogens as they become available, and there are signs that this campaign is bearing fruit.

Particular mention may be made of a series of enzyme-producing *Aspergillus* spp. obtained from the N.R.R.L. Collection in the U.S.A. 2,053 cultures were supplied as follows: research and education: 915 (755 in 1959/60), industry: 968 (815 in 1959/60), free and exchange: 181 (232 in 1959/60). Total value of sales: £1,044 (£775 in 1959/60).

During this last year the increasing number of cultures to be maintained and the increasing number of orders has placed a correspondingly greater burden on our present complement of 2 technicians. The expected appointment of a third technician early in 1961 will relieve this pressure and also greatly facilitate identification and experimental work.

164. The Culture Collection has continued to deal with a steady flow of diverse enquiries from industrial firms, research associations, and government departments. A number of clients have consulted us on tropic testing procedures. In addition, suspect results from tropic tests on cable samples were checked and currently an investigation of the effectiveness of filter paper + Czapek solution test pieces in the humidity chamber is being carried out in association with the Atomic Weapons Research Establishment.

165. Investigations of industrial moulding problems have included several interesting cases: the eradication of mould growth on cast alloy gyroscope casings, where there was apparently a danger that the spores would enter and upset the delicate bearings of the instrument. Substitution of a mineral grease for lanolin solved the problem.

166. Air ducting from car heater units were developing mould growth, and a request was received to comment on its danger to health of workers. The predominant fungus proved to be *Aspergillus fumigatus*, and the use of suitable respirators by workers was therefore recommended as a precaution. Mould growth on rubber components of electrical equipment was eliminated by the substitution of a plastic component. On the other hand, investigation of suspected mould growth on pressure gauge components showed that the deposit was purely of an inorganic nature.

167. Mould growth on a large consignment of meat imported from South America under refrigeration proved to be due to *Chaetostylum sp.* Advice on determining the source of infection and possible sanitary measures was given.

168. Other enquiries sought advice on the mould proofing of gummed labels and parachutes, moulding of accumulator components, materials suitable for export furniture, enzymes produced by Aspergilli, and several requests for information on the growth of fungi in culture. A number of cultures were identified for industrial firms.

169. Mr. Elphick has continued to identify *Penicillium*, *Aspergillus*, *Verticillium*, *Paecilomyces* and various other phialide- and aleuriospore-producing genera. Miss Stockdale has identified fungi from human and animal sources, Gymnascaceae and, since the departure of Dr. Davies, has taken over the Mucorales and other genera of the lower ascomycetes and has performed occasional identifications of yeasts.

170. Although some experimental work on the growth of fungi in culture has continued (e.g., the effect of light on sporulation and the Heald-Pool effect) much of this has been held over until next year when the appointment of a third technician will enable a more ambitious programme to be planned.

171. Miss Stockdale has continued her studies of techniques for the production of the perfect states of soil fungi and published a paper '*Nannizzia incurvata* gen. nov., sp. nov., a perfect state of *Microsporum gypseum* (Bodin) Guiart et Grigorakis' in *Sabouraudia*. **1**, 1, 1961.

172. *Bacteriology*. 288 identifications have been made over a wide range of plant materials. Although not a new host record, the occurrence of *Pseudomonas solanacearum* on teak seedlings in Malaya, illustrates the versatility of this soil-borne pathogen. *Corynebacterium michiganense* was identified on tomato material from Southern Rhodesia, and a bacterial culture from a leaf spot on *Tripsacum laxum* in Ceylon has been identified as a *Xanthomonas* sp. This is apparently a new host record for the Gramineae.

173. Dr. Hayward visited Mauritius, Madagascar, Réunion, and Natal during October and November, 1960, to investigate the breakdown of sugarcane varieties hitherto resistant to gumming disease. A comparative study is being made of *Xanthomonas vasculorum* strains from different territories and of the bacteria causing red stripe disease and mottled stripe disease of sugarcane in the four territories.

174. Specimens of cushion gall of cacao collected in Ghana, Costa Rica, Trinidad, British Honduras, Venezuela, and Jamaica have been examined exhaustively for the presence of a likely bacterial pathogen. Although much of the material bore large numbers of an organism indistinguishable culturally and physiologically from authentic cultures of the crown gall pathogen, *Agrobacterium tumefaciens* (Smith and Townsend) Conn, inoculation experiments carried out by workers at the West African Cocoa Research Institute, Ghana, with isolates of this bacterium from Ghana material, have been negative. Most recent work in Ghana suggested that the disease is of fungal origin and no further bacteriological work is envisaged.

175. Research on *Xanthomonas* and related yellow bacteria continues. A preliminary study has been made of a group of pink pseudomonads occurring on tropical plant material and in soil, some strains of which are capable of causing spoilage on ginned cotton lint under conditions of high temperature and humidity in Nigeria.

176. Research continues on the characterisation and systematic position of *Pseudomonas solanacearum* and related plant pathogenic and other sudanophilic pseudomonads.

177. *Photography.* The following have been supplied to the Herbarium:

1,320 pages of *Michelia*, Vols. 1 and 2; 2,780 pages enlarged from microfilm, 614 bromide prints, and 20 lantern slides.

178. *Information Service.* Orders for photographic reproductions have been supplied as follows:

Microfilms—Commonwealth 46 orders
—Foreign 20 orders
Photocopies—97 pages.

179. The following offset reprinting has been done; 30 parts *Review of Applied Mycology*, 2 Mycological Papers, 70 Distribution Maps of Plant Diseases. Also printed by photo-offset have been 3 bibliographies, 1 Culture Collection Catalogue and supplements, advance summaries of papers for the 6th Commonwealth Mycological Conference, and miscellaneous forms.

180. *Inter-African Phyto-Sanitary Commission.* Previous to his retirement, Mr. Altson completed fifth list of plant viruses, 55 being included, bringing the total to 305. Details of their synonymy, geographical distribution, natural hosts, and mode of transmission were given. A further list is now being prepared. In addition, information on a number of subjects, especially the distribution of certain plant diseases, has been collated for the use of the Commission. Mr. Altson attended its fifth annual meeting held in London in October and retired in November, 1960. He was succeeded by Mr. R. W. Rayner, lately Coffee Research Officer, Kenya.

The usual close liaison has been maintained with the Scientific Secretary to the Commission.

181. *Colonial Pool of Plant Pathologists.* Mr. Holliday concluded his studies of the foot-rot of black pepper (*Piper nigrum*) in Sarawak and on his return to England in December resigned from his post in order to take up a lectureship at Hull University.

The main conclusions from his investigations are that the disease is the result of attack by a species of *Phytophthora*, that the traditional methods of husbandry employed favour its spread, and that a considerable degree of control could be obtained if these were modified. Such methods as fencing, disinfection on entering plantings, abandonment of clean weeding, bottom pruning of lateral branches, and a careful choice of planting sites are suggested. Some control should also result from the treatment of the soil with a dry copper fungicide and by the use of resistant varieties.

182. Dr. Wheeler has continued his studies of withertip of limes (*Gloeosporium limetticola*) in Zanzibar. He was on home leave from the end of March to the beginning of August.

183. Trials with kramsol (phenyl mercury nitrate) have been continued and various modifications to the spray schedule to reduce the number of applications have been tried with encouraging results. Tree flushes in September to December were found to produce the greater proportion of the crop and it may be possible to restrict spraying to these.

Seven other sprays have been tested; but none gave better disease control than kramsol, though some interesting results were obtained.

184. Investigations on the absorption of mercury and on the level of copper deposited on lime leaves sprayed with copper fungicides were carried out in co-operation with Long Ashton Research Station, Bristol. The level of mercury found in fruit from trees sprayed with mercurial fungicide was not thought to present any serious toxicity problem.

Studies on spore germination and the requirements for infection have been made.

185. *Publications.* Sales of publications and cultures amounted to £11,655, a decrease of £864 on 1959/60. Subscribers to the *Review of Applied Mycology* increased by 38, from 1,497 in 1959/60 to 1,535. Sales decreased from £7,695 (back numbers £2,559) to £6,588 (back numbers £1,687) due to a drop in the sale of back numbers which was exceptionally large in 1959/60.

186. The distribution of the *Review of Medical and Veterinary Mycology* decreased from 463 to 458 and sales from £1,121 to £946, mainly due to drop in the sale of back numbers. The assistance of voluntary outside abstractors, particularly Prof. Juan E. Mackinnon of the University of Montevideo, is gratefully acknowledged.

187. *Mycological Papers.* Nos. 76 to 79 inclusive were issued; sales amounting to £900 (£837 in 1959/60).

188. Sales of *Phytopathological Papers* amounted to £49, but no new numbers were published. Two, however, are in an advanced stage of preparation and it is expected to send one on Panama disease of bananas to press by the middle of 1961.

189. The distribution of *Commonwealth Phytopathological News* rose from 416 to 434 but sales dropped from £118 to £109. Distribution of the *Index of Fungi* also dropped from 432 to 424 and sales from £396 to £374.

190. Distribution and sales of the *Bibliography of Systematic Mycology* and *Distribution Maps of Plant Diseases* both increased, the former from 64 to 95 (£89) and the latter from 329 to 370 (£228).

191. There was a steady demand for books published in previous years, 'Tobacco Diseases' (104), 'A Manual of Rice Diseases' (73), 'An Annotated list of Seedborne Diseases' (84) and 'An Introduction to the Taxonomy and Nomenclature of Fungi' (63) being noteworthy. 'Leaf Curl Disease of Cotton' is now out of print.

192. Two books were issued, namely, the 'Herb. I.M.I. Handbook' and the 5th edition of 'Ainsworth and Bisby's Dictionary of the Fungi' and proved immediate successes. Sales of the former amounted to £188 and of the latter to £486.

193. The publication of Dr. Tarr's book 'Diseases of Sorghum and Sudan Grass' was unfortunately delayed mainly through shortage of clerical staff, but the copy is now with the press.

194. *Changes in Staff.* Major H. A. Dade retired in September, 1960. Dr. R. R. Davies resigned to take up another appointment in December, 1960.

195. Miss Phyllis Stockdale was appointed as assistant mycologist in the Culture Collection in July, 1960.

COMMONWEALTH INSTITUTE OF BIOLOGICAL CONTROL

196. Headquarters of the Commonwealth Institute of Biological Control have remained at Ottawa. The Director has spent some time at the European and West Indian Stations and has been on tour in Africa, visiting Tanganyika, Kenya, Southern Rhodesia, Union of South Africa, Nigeria, Southern Cameroons, Sierra Leone and Gambia, and later to Trinidad, Barbados, and the Bahamas. Investigations on a number of additional projects have been requested by various countries as a result of discussions held in the different countries visited.

197. The question of developing biological control work in East Africa still remains undecided awaiting sufficient financial support by the East African territories for projects of interest to the area. It is hoped that this position will soon be improved and that the Institute will be able to carry out some useful work for this area.

198. Dr. Lloyd has left to carry out investigations on several projects in southern South America; Dr. Bennett has spent some time in the U.S.A., Bermuda, Jamaica, Barbados, St. Kitts and Nevis on various projects; Dr. Carl spent eight months at the Pakistan Station.

199. At the Californian Station projects have been carried out for Australia, India, Pakistan, Union of South Africa and Canada. The European Station has worked on a number of problems of interest to Canada and New Zealand; the Indian Station on those of interest to Australia, Ceylon, India, Mauritius, New Zealand, Pakistan and also for Mexico and the U.S.A. At the Pakistan Station work has been done for Australia, Pakistan and the U.S.A. At the West Indian Station projects have been carried out for Australia, Barbados, Bermuda, India, Jamaica, The Federation of the West Indies, U.S.A. and the Virgin Islands.

200. Most members of the staff have had to travel extensively in connection with these various projects and have also, during the course of the year, produced very valuable contributions to the scientific aspects of biological control; 17 papers comprising 358 printed pages have been published by the Institute's staff.

201. *693* shipments comprising *107* species of beneficial insects, a total of *454,738* individuals, have been sent to *20* countries during the course of the year in connection with work on *53* projects.

202. Mr. E. A. Cameron, B.S.A., has joined the staff and is stationed at California.

203. During the year a number of successful establishments of material shipped by the Institute to various countries have been recorded, and other information received regarding developments of control in connection with other projects. These include the establishment of *Prospaltella perniciosi* and *Aphytis diaspidis*, parasites of the San Jose scale, in New Zealand, that of *Azya trinitatis* and *Cryptognatha nodiceps* against coconut scale in Jamaica and that of *Agathis stigmatera* in Mauritius against sugar-cane borers. In Bermuda *Azya luteipes* and *Cryptolaemus montrouzieri* are well established and controlling *Pulvinaria psidii* in some areas. Here also the predacious snail, *Euglandina rosea*, is firmly established and is thought to be reducing numbers of the pest snail, *Otala lactea*. In Bermuda, too, a nymphal parasite, *Carabunia myersi*, of the leaf hopper *Clastoptera undulata* has been successfully introduced following Dr. Bennett's investigations in Jamaica. The parasite appears to be well established but it is too early to assess its influence on the population of the pest.

204. In Barbados *Lixophaga diatraeae* (several strains from Antigua, Cuba, Jamaica and the Dominican Republic) have been liberated in large numbers against the sugar-cane borer *Diatraea saccharalis*. Recoveries have been made, but as yet permanent establishment cannot be claimed.

205. Further reports from Nevis indicate that the control of *Opuntia triacantha* by means of the moth *Cactoblastis cactorum* introduced there has been most successful and spectacular.

206. There has been, over the past twelve months, continued increase in demands for the

services of the Institute and this is reflected in a considerable increase in the amount of project funds made available. It is hoped that this improved utilization of the services offered by the Institute will continue and every effort will be made to encourage this by continuing to provide as much information on biological control by means of reports and memoranda dealing with important and widespread pests.

COMMONWEALTH BUREAUX

Animal Breeding and Genetics

207. *Staff.* Mr. P. W. Swire, M.R.C.V.S., Assistant Director, resigned as from the end of March, 1961.

208. *Accommodation or Equipment.* Plans for the new headquarters of the Animal Breeding Research Organization of the Agricultural Research Council have now been completed and approved and include adequate accommodation for the Bureau, with a fairly large library space.

209. *Publications.* Volume 28 of *Animal Breeding Abstracts* contained four review articles and 2416 abstracts and titles, representing an increase of 10 per cent. over the previous volume. Dates of publication were brought forward to the beginning of March, June, September and December. Only 5 per cent. of the abstracting was done by outside abstractors.

T.C.14, The Indigenous Livestock of Eastern and Southern Africa, by I. L. Mason and J. P. Maule, was published in August, 1960.

210. *Information Service.* There were 71 major enquiries during the year; 25 from the United Kingdom, 29 from other Commonwealth countries, one from the Republic of Ireland and 16 from foreign countries. The enquiries covered the usual wide range of subjects from some 25 countries and included requests for information on the production of 'cashmere' wool in the U.S.S.R.; the heat tolerance of the Australian Illawarra Shorthorn breed, with a description of the breed and its performance; shrinkage losses incurred by pigs in transit to bacon factory; the origin and domestication of the South American vicuna; the age of sexual maturity in ram lambs in the tropics; sources of the trypanosomiasis-tolerant West African N'Dama cattle for tsetse research in East Africa; and references to work on the inheritance of resistance to diseases in cattle, pigs and poultry and to the genetics of udder characteristics, milking rate and milk composition in cattle.

211. The Bureau dealt with 11 requests for translations, mainly of short items, and with 9 requests for photocopies of papers.

212. *Library.* The library issued on loan a total of 618 items and borrowed 1139 items. It now has a total of 2021 books and runs of 171 different journals, as well as a large collection of reprints.

213. *Newsletter.* This continues to be a useful link with research workers overseas and was sent to approximately 170 correspondents during the year.

Animal Health

214. *Staff.* No change.

All three of the Bureau's periodicals have been produced regularly and promptly and sales have increased steadily during the year. The volume index for the 1960 volume (Vol. 30) of *Veterinary Bulletin* was sent out to subscribers in January, 1961 which is earlier than in past years.

215. Sales of *Veterinary Reviews and Annotations* although they increased by about 5 per cent were still rather disappointing. The Review Conference recommended that the publication of review articles in a separate journal should cease and that instead they should be included in the abstracting journal—*Veterinary Bulletin.* This recommendation has been accepted by the Executive Council and the 1961 volume (Vol. 7) of *Veterinary Reviews and Annotations* will be the last which will be published. From January, 1962 onwards review articles will be included in the *Veterinary Bulletin.*

216. No technical communications were published during the year 1960.

217. The information service dealt with 111 enquiries on a wide variety of subjects. Of these 20 came from the Dominions, 14 from other Commonwealth countries, 14 from foreign countries and 63 from the U.K. Among the subjects on which information was required were: bovine chronic haematuria; diseases of laboratory rats; strangles in horses; leptospirosis in hamsters; diseases of yaks, facial eczema of sheep, poisoning of pigs by coal-tar-pitch from clay pigeons on shooting ranges; and many others.

218. *Miscellaneous.* Books to the value of £240 were received from publishers for review in the *Veterinary Bulletin.* Final figures for revenue from advertisements in the journals are not available at the time of writing but it is estimated that the total will be about £350.

219. The delegates to the C.A.B. Review Conference 1960 spent two days (5th and 6th September) at Weybridge and saw something of the work of the Bureau and of its parent Institute. They were entertained to lunch and tea on both days by

the Central Veterinary Laboratory for which thanks are due to the Consultant Director, Dr. A. W. Stableforth.

Animal Nutrition

220. *Staff.* The Scientific Assistants cadre was one below strength for ten months of the year.

221. *Publications.* (*a*) *Nutrition Abstracts and Reviews* continued to expand. Volume 30 contained 176 more abstracts and 1351 more titles than did Volume 29. The total number of entries, numbered and unnumbered, was 11,441.

(*b*) Three of the four Review Articles printed during the year were closely linked with the Bureau, a member of its staff being the senior author in each case, Mrs. F. C. Aitken for two of them and Dr. Leitch for one. One of the three was entirely produced in the Bureau. A member of the staff of the Rowett Research Institute provided the first quarter's review, and another was an associate author of the one published in the last quarter.

(*c*) A Technical Communication, *Diet in relation to reproduction and the viability of the young.* 3. *Pigs*, by Dr. D. L. Duncan, Assistant Director and Dr. G. A. Lodge of the Applied Nutrition Department, Rowett Research Institute, was published.

222. *Information Service.* The number of enquiries fell in comparison with that for the preceding year. Of the total of 44 which were received, 39 were from Commonwealth countries, 4 from foreign countries and 1 was from an international organization. Of these 31 concerned animal feeding, 4 human nutrition and the remainder were on other subjects such as composition of foods either animal or human.

223. The difference in the incidence of peptic ulcer in the populations of New Zealand and Scotland, the disorder being much less common in New Zealand, prompted a Professor of Surgery in Scotland to ask for information about diet surveys which might explain the difference. Although results were made available they provided no indication of the cause of the difference. A subject on which little information was available was the feeding of yaks, a subject of enquiry by the Indian Council of Agricultural Research. An unusual request came from a Dutch firm of feed manufacturers who asked for the exact meaning of the English word *prills* and to whom the only answer that could be given was the definition contained in the Oxford English Dictionary and which appeared to have no significance in food technology.

224. Publications numbering 10 were requested by outside borrowers through the Bureau from the Reid Library of the Rowett Research Institute.

225. *Sales.* Total circulation of *Nutrition Abstracts and Reviews* continued to increase; for Volume 30 it was 2138 compared with 2085 for Volume 29. The number of subscribers went up by 49 to 1833.

Total income from the sales was £13,165. The total value of circulation for Volume 30 was £15,086.

Dairy Science and Technology

226. *Staff.* No changes to report.

227. *Publications. Dairy Science Abstracts* was published regularly every month throughout the year.

Volume *22* (1960) contained the record number of 3,335 abstracts and 269 title entries. In addition, review articles written by dairy scientists in Great Britain, Australia, India, France and Norway, appeared regularly in the journal.

The annual author and subject index to Volume *22*, now a publication of over 100 pages, was again published in record time, in early February, 1961.

Coverage of the literature continued to increase and some 570 journals are scanned regularly, apart from numerous bulletins, annual reports, patents, books and other publications. The proportion of foreign language abstracts and titles increased during the year and amounted to 42·5 per cent. of the total number of abstracts and titles recorded in *Dairy Science Abstracts*. German and Eastern European languages continued to be the most important of the foreign languages.

228. *Journal sales.* The sales of *Dairy Science Abstracts* continued to rise during the year and the number of subscribers rising from 1,815 for Vol. *21* to 1,854 (including nearly 900 in the United States) for Vol. *22*. The total circulation of the journal (including free and quota copies) rose from 2,040 for Vol. *21* to 2,079 for Vol. *22*.

229. *Information Service.* The total number of enquiries received and dealt with by the Bureau during the year reached the record total of 214, compared with 176 in the preceding year. Of these, 133 came from Great Britain and the Commonwealth, and 81 from foreign countries.

230. The following are examples of a number of interesting enquiries received from Commonwealth countries:

(*a*) Bibliographies on sulphydryl groups in milk, and the feeding of urea as protein supplements for dairy cows were prepared for British enquirers.

(*b*) The Indian Council of Agricultural Research was supplied with an annotated bibliography on Yak's milk, yield and composition, in connection with a general survey of Yaks in India.

(*c*) Information on dairying education in this country was given to the Commonwealth Relations Office in response to an enquiry received by them from India.

(*d*) Interest in the manufacture of ripened cream butter by the Fritz continuous process was expressed by a South African firm which was supplied with the relevant information.

(*e*) The Department of Agriculture in South Africa was provided with a detailed bibliography on the manufacture of rennet while another enquirer from South Africa was given detailed information on the amido black method of milk protein determination.

(*f*) Australian research workers were supplied with varied information ranging from methods of detecting residues of sodium hypochlorite and Q.A.C. compounds in milk, to formulae for soft ice cream and the use of cultured milks in milk chocolate, while a number of extended abstracts, chiefly of Russian research papers, were sent to New Zealand research workers.

231. *Advertisements.* Vol. *22* of *Dairy Science Abstracts* contained 31 pages of paid advertisements.

Forestry

(*Note:* Figures in brackets are last year's, for comparison.)

232. *General.* The Bureau came of age this year, completing its 21st Volume, and the occasion has been signalized by four happy occurrences:

(i) the cadre of 8 scientific assistants has remained unchanged, at full strength;

(ii) the paid circulation of *Forestry Abstracts* has for the first time exceeded the 1,000 mark;

(iii) the total of cards and flimsies, despatched in the Centralized Title Service, already in its 10th year, is now close on the one million mark;

(iv) A brochure, illustrated in colour, of the work and growth of the Bureau was published.

233. *Staff.* A year—thankfully recorded—of stability and consolidation as regards the scientific staff, though one, unfortunately, of casualty and change among the senior clerical and typists.

234. *Publications.* (*a*) The production of *Forestry Abstracts* continues to be the major pre-occupation of the staff. All numbers appeared practically on time; part of the index to Vol. 21 will shortly go to press.

Vol. 21 contained 5237 (5452) notices from 34 (34) languages, extending to 640 (622) pages, the biggest abstracts text published to date.

(*b*) *Coverage of literature.* Reappraisal continues in connection with the new Coverage List of periodicals and serials (the first two instalments of which were published during the year by FAO), involving both discards and accessions of literature, and some reclassification.

(*c*) *The Botanical Pool* of circulating literature (some 247 items) continued to be run by this Bureau, which also continued the distribution of scientific literature received at Head Office.

(*d*) *Occasional Publications.*

(i) *Special projects.* Compilation of Part II of the five-year index to Volumes I-V of *Forestry Abstracts* was completed and is now awaiting final check and editing.

The illustrated brochure entitled "A Synopsis of the Work and Growth of the Commonwealth Forestry Bureau, Oxford, 1939-1959" was published in September, 1960, just in time for the Review Conference.

(ii) *Technical Communications*—Revision and further compilation of the T.C. on Shelterbelts have begun.

(*e*) *Centralized Title Service.* This weekly service of abstract references continues its steady growth, at least outside the Commonwealth, which dropped two subscriptions against 10 new foreign subscriptions. A total of 112 (104) countries now take nearly one million cards, well over a quarter of this output going to the U.S.A. New countries subscribing were Argentina and Liberia.

235. *Information Service.* (*a*) A total of 31 (30) enquiries was received and dealt with from member or associated countries, the same figure as last year, plus 5 (11) from foreign countries. Among topics on which information was provided were:

1. The percentage of cholesterol and phytosterol in acorns.
2. Causation of buttresses on tree stems.
3. Application and development of the classical silvicultural systems outside Europe.
4. Concentrated poison pellets for killing trees.
5. Occurrence of White Pine blister rust in Central and South America.
6. Control of mistletoe on Teak by systemic poisons.
7. Application of radio-isotopes to the study of genetics, seed germination and penetration of wood by preservatives.
8. Extraction and composition of the oil of the candlenut tree (*Aleurites moluccana*).

(*b*) In addition there were 33 (34) requests for literature, involving 170 (64) items; 13 (3) photostats, 2 (2) microfilms and 1 (2) translations were also supplied.

236. *Miscellaneous.* The authorized edition in French of the *Oxford System of Decimal Classification for Forestry* has been published; that in Italian should appear shortly. A Portuguese version is also being prepared.

Helminthology

237. *Changes of staff.* Dr. J. M. Watson resigned from his post as Director and Dr. Sheila M. Willmott was appointed Acting Director until further notice.

238. *Identifications.* Material from Kenya, Nigeria, Northern Rhodesia, Southern Rhodesia, Mauritius, Norway and Liberia was dealt with during the year.

239. *Publications.* Volume 26 of the old series and Volume 29, the first volume of the new series of *Helminthological Abstracts* was completed and published during the year. Volume 29 contained 2374 abstracts and titles in 34 languages; Volume 26 contained 1971 abstracts and titles.

240. *Information service.* 49 requests for information were received during the year, 41 from contributing countries and 8 from non-contributing countries and international organizations. Topics included:

(*a*) The life-cycle of *Daubaylia potomaca* in planorbid snails (U.S.A.); *Metorchis conjunctus* and virus epidemic in Eskimo sledge-dogs (Canada); control of lungworms in sheep (St. Helena); *Trichinella* in moles in Poland (U.K.); plant-parasitic nematodes in Africa (Inter-African Phyto-Sanitary Commission); *Heterodera rostochiensis* in India; trichinelliasis infection in coypu (Kenya); distribution of *Haemonchus* in goats (Nigeria).

(*b*) Requests for specific items of literature numbered 80 and for microfilms and photocopies 43. Two translations were supplied.

241. *Miscellaneous.* The committee of experts as recommended by the 1960 Review Conference to advise on the future of the Bureau held its first meeting on 6th March. The composition of the committee was as follows:

Dr. E. L. Taylor, C.B.E., D.V.Sc., M.R.C.V.S., D.V.H., N.D.A., N.D.D., (Formerly Deputy Director, Veterinary Research and Veterinary Investigation Services, United Kingdom Ministry of Agriculture, Fisheries and Food)—Chairman.

Professor J. J. C. Buckley, D.Sc., Department of Parasitology, London School of Hygiene and Tropical Medicine.

Professor B. G. Peters, Ph.D., A.R.C.S., Department of Zoology and Applied Entomology, Imperial College of Science and Technology, London University.

Mr. F. G. W. Jones, M.A. (Cantab.), Head of the Nematology Department, Rothamsted Experimental Station.

Mr. J. E. C. Coventry, B.A., M.Sc., Rhodesia and Nyasaland Scientific Liaison Office, Africa House, Kingsway—Representing the Executive Council.

242. The Bureau had 23 visitors during the year amongst whom were:

Professor T. W. M. Cameron (Canada)
Dr. and Mrs. J. A. Dinnik (Kenya)

Horticulture and Plantation Crops

243. *Staff.* No changes in senior staff.

244. *Publications.* (*a*) *Horticultural Abstracts.* Volume 30 was published on time and contained abstracts, notes or reviews of 6332 articles and books, an increase of 12 per cent over Vol. 29. No index was issued to Volume 30. Instead, a cumulative 5-year index, covering Volumes 26-30, has been prepared and is now in proof.

(*b*) *Occasional publications.* Digest No. 2. *Mist propagation of cuttings* was reprinted in December, 1960. Several new occasional publications reached an advanced stage of preparation but none was issued.

245. *Information Services.* (*a*) *Existing services:* Enquiries dealt with rose by 15 per cent to reach a total of 240, which was made up of 100 from the United Kingdom, 56 from the Dominions, 27 from the Colonies, 1 from the Republic of Ireland, 1 from the Republic of Sudan and 55 from foreign countries.

Official Correspondents and all readers of *Horticultural Abstracts* were notified of the availability of copies of replies to the more interesting enquiries. As a result, 231 persons were supplied with 863 copies of replies to 105 enquiries.

Subjects of enquiries covered the usual wide and interesting range, but none calls for special mention.

(*b*) *New Services:* The photocopying and translation services started 18 months ago may still perhaps be classed as 'new'. The photocopying service has proved well worth while, 79 persons being supplied with copies of 165 articles (123 photostats and 42 microfilms). The translation service has also made progress. In all, the Bureau was asked to translate 45 papers in 7 foreign languages, but of these 8 were turned down for various reasons. Sales of translations totalled 284 copies.

246. *Publicity.* Bureau publications were again displayed at the Chelsea Flower Show, held in London in May, 1960. Leaflets and order forms distributed to several thousand addresses resulted in exceptionally rapid sales of Digest No. 2, the initial print order of 2,000 copies being all sold out within a year of the date of publication. Leaflets advertising translations have so far been sent to more than 100 libraries.

Pastures and Field Crops

247. *Staff.* The difficulty experienced in dealing with the increased volume of scientific articles and reports, mentioned in the last Annual Report, was accentuated during 1960/61 by the resignation of

two Scientific Assistants. Even had the staff been up to its full establishment, it would still have been impossible to keep abreast of the current scientific literature received for abstracting. Since 1955 the number of abstracts and titles published per annum in the two abstract journals, *Herbage Abstracts* and *Field Crop Abstracts*, taken together, has risen by 38 per cent.

248. *Publications.* *Herbage Abstracts* and *Field Crop Abstracts* each appeared quarterly but, because of shortage of staff, *Herbage Abstracts* Vol. 30, No. 4 appeared 3 weeks late. The numbers of abstracts and titles published in *Herbage Abstracts* and *Field Crop Abstracts* were 1926 and 2070, respectively. These were derived from eleven languages. In addition to abstracts, a review article was published in each issue of both journals. The number of periodicals and reports examined by the Bureau was 1059.

The annual subject and author indexes of *Herbage Abstracts* and *Field Crop Abstracts* were published with the last issue of each volume.

There were small increases in the circulation of *Herbage Abstracts* and *Field Crop Abstracts.*

Bulletin 45, Research techniques in use at the Grassland Research Institute, Hurley, reached the page-proof stage. Five other technical communications are being prepared for publication. A compilation giving brief details of current agricultural research in Africa on annual field crops and grasslands was prepared for publication.

An exhibition of C.A.B. publications was organized by the Bureau at the 8th International Grassland Congress, Reading.

249. *Information service.* 89 enquiries (83 from Commonwealth countries and 6 foreign) were answered. In addition, 214 requests for references to scientific literature, 20 requests for reproductions (microfilms or photocopies) and 11 requests for translations were received.

250. Enquiries received covered the following subjects, among others: Fungicides for legumes; the effect of saline conditions on crops and the use of sewage and industrial effluents for irrigation; management of grassland in tropical Africa; development and morphology of oats in relation to attacks by frit fly; rice research organizations; lucerne drying; growth analysis of crop plants; measuring fertilizer response on grassland by means of grazing animals; effect of dust upon land, crops and livestock; control of *Equisetum arvense*, *E. palustre* and *E. pratense*; breaking dormancy in potatoes; ant hills and termite mounds in relation to pasture; productivity of five grass species (sown with white clover) at six fertility levels; fodder roots in Britain; *Lotus uliginosus* Schk; *Striga* infestation in maize; shrubs and trees as fodder; pastures and pasture management in sub-tropical and tropical regions; toxic plants in Sierra Leone; hay-making with lucerne in tropical and sub-tropical regions. Lists of the more important enquiries answered were published in *Herbage Abstracts* and *Field Crop Abstracts* and carbon copies of replies were offered to those who wanted them.

251. *Miscellaneous.* The Assistant Director visited Ghana, Nigeria and F.A.O., Rome, during October/November.

Forty-six scientists from overseas visited the Bureau.

Plant Breeding and Genetics

252. *Staff.* No changes to report.

253. *Plant Breeding Abstracts* has continued to appear punctually at the beginning of each quarter. Volume XXX contained 4450 abstracts and 100 book reviews and 5 new journal notices. Publications in 35 languages were examined in the course of preparing *Plant Breeding Abstracts* and 5 other languages were dealt with in the course of the bureau's work.

254. There were 38 technical enquiries from Commonwealth and associated countries. These included requests for information on the following topics: *Camelina* breeding, genetics of seed shape and *Pythium* resistance in peas, resistance to tobacco mosaic virus in tomato and red pepper, genetics of sucrose content in sugar beet, and clover vernalization, for Canada; pollen storage, and *Eleusine* breeding for India; Ethiopian cereals and grasses, for Kenya; pollen storage and *Andropogon* breeding, for Nigeria; tea breeding, for Nyasaland; wheat varieties, and breeding techniques, for South Africa; heterosis in maize, for Southern Rhodesia; and wheat composites, competition in cereals, drought resistance in cereals, frit fly, breeding for nutritive value, and virus tolerance and resistance, for the United Kingdom. Assistance was also given to the editors of the forthcoming *Flora Europaea.*

255. Requests for specific items of literature totalled 198; 231 requests were made for bibliographies previously compiled. Three translations from Russian were provided. Requests for microfilms and photocopies totalled 15.

256. Assistance was rendered in obtaining seed of *Melilotus bicolor* for Canada and of *Stylosanthes* sp. for Uganda. Arrangements for irradiation of cotton seed by the U.K. Atomic Energy Authority were made on behalf of the Gatooma Research Station, Southern Rhodesia.

257. Visitors to the bureau included: C. H. Goulden and Prof. L. H. Shebeski, from Canada; E. L. Mehra, from India; A. W. Waitts, from Nigeria; P. G. Christidis, from Greece; R. L. Cuany, from Turrialba, Costa Rica; F. Mohrhardt,

Director of the U.S. Department of Agriculture Library, to discuss mechanization of scientific information files, and M. G. Weiss, from Beltsville, U.S.A.; and A. I. Cherny, Scientific Secretary of the Department of Scientific Methods of Information and Documentation of the U.S.S.R. Academy of Sciences.

258. The Director attended the 1960 meeting of the International Commission for the Nomenclature of Cultivated Plants at Cambridge and was elected a Corresponding Member of the Accademia dei Georgofili in Florence.

Soils

259. *Staff*. No change.

260. Publication of *Soils and Fertilizers* is up to date. There is a big backlog of typing of abstracts to be dealt with somehow.

Vol. XXIII (1960) contained 2879 abstracts and nine review articles.

Technical Communication No. 51, *The Soil under Shifting Cultivation*, was published. No. 52, *The Trace-Element Content of Fertilizers*, was sent to the press.

261. The number of enquiries received was 172, compared with 141 in the previous year. Of these 66 came from the United Kingdom, 38 from Canada, and 41 from other contributing countries. Among the subjects of enquiry were: the use of fluorescin dye to detect seepage (Swaziland); the effect of frost on soil aggregation (Canada); metabolism of earthworms (New Zealand); soil protozoa, for which a complete bibliography covering 30 years was prepared (New Zealand); effect of nuclear fall-out on soils (Canada); land classification (Canada); restoration of opencast mined soils (U.K.); role of enzymes in soil respiration (New Zealand); citrus fertilizing (Trinidad).

262. Fourteen translations, 6 from Russian, 4 from German, and one each from French, Czechoslovakian, Swedish and Norwegian, were made.

263. One hundred and fourteen annotated bibliographies were prepared.

264. The Director made an eight-week tour of Canada, and subsequently attended the Seventh International Congress of Soil Science at Madison, U.S.A.

NOTES OF PROGRESS IN THE AGRICULTURAL SCIENCES, BY DIRECTORS

265. The Review Conference, 1955, commended this new feature and considered that such reports were of special interest not only to administrators but to workers generally in science, agriculture and forestry. The Conference noted that each Director contributed a summary of progress each year. It was considered that in general this short period did not allow of the reports being significantly different from year to year and the Conference felt that although such notes of progress should remain an integral part of the annual report, each Director should normally be expected to provide a contribution only once in three years. Strictly adhered to this might result in a revolutionary discovery remaining unreported for too long but a revolutionary discovery would be a good reason for departing from the rotation. The Conference could see no useful purpose in issuing these notes of progress separately for sale and considered that the practice of issuing these notes as separates should be discontinued.

266. Notes of progress accordingly appeared in 1956-57 for one institute and four bureaux, in 1957-58 for one institute and three bureaux, and in 1958-59 for one institute and three bureaux. The full cycle was then repeated from 1959-60, and this year it is again the turn of the Institute of Biological Control, Bureau of Dairy Science and Technology, Bureau of Helminthology and Bureau of Horticulture and Plantation Crops.

267. The Review Conference, 1960, has recommended that Directors once again prepare notes of progress annually, broadening the presentation to include discoveries or developments of particular interest to scientists who direct agricultural professional services.

Biological Control

268. Biological control is to a large extent a specialized branch of entomology and developments in this more general field of agricultural science influence the general trends in biological control work. Recent progress in the entomological field was described by the Director of the Commonwealth Institute of Biological Control in the 1959-60 Commonwealth Agricultural Bureaux Report and in this was included paragraphs (128 and 129) on developments in biological control.

269. Since biological control is essentially of practical application a report on progress should obviously include an account of results achieved, in addition to reference to the more fundamental aspects of population dynamics and methods of estimation of the actual effects of various factors, including biotic agents, on insect populations, and the more recent ideas as to the best way of attacking biological control problems.

270. The controversial subject of the theories of population dynamics has received increased attention over the past few years (see Watt, 1959, 1960)

and moreover there have been intensive efforts made in Canada (Morris *et al.*, 1955 etc.) to obtain accurate information as to the exact effect of various individual factors, including introduced species of parasites and predators, on the fluctuation in the field of populations of forest insects. Such work is of obvious fundamental importance in assessing the value of biological control agents but it should be emphasised that such research necessitates considerable expenditure in time and effort, and that it is difficult if not impossible to apply the results obtained to other problems of biological control.

271. It is being increasingly realised that the value of the highly toxic modern insecticides is not as unlimited as was originally supposed, and the development of insect resistance and the recognition of detrimental side effects of the widespread use of these insecticides has been fully recognised for many years. This has led, particularly in the past few years, to a distinct change in general thought with regard to alternatives to chemical control and to biological control in particular. Especially with those problems in which adequate control by means of insecticides is becoming increasingly expensive and hazardous a greater interest is being shown in the possibilities of biological control, even with the problems where this method appears unpromising (e.g. the codling moth, *Carpocapsa pomonella*, sugarcane frog-hopper *Aeneolamia varia*).

272. In this connection particularly, but also in a general way, the present emphasis is on more basic investigations of the ecology of both the pest and its natural enemies in its country of origin with a view to obtaining detailed information as to the value of individual parasites and predators in limiting populations, and in order to obtain some tentative estimate of their potentialities as controlling agents when introduced into areas where the pest has become established. This involves long term research and has been and is being done, for example, at our European Station in connection with attempts at the biological control of several pests in Canada (e.g. *Adelges* spp., *Pristophora erichsonii*). As a development of this more detailed consideration is being given to the evolutionary background of the distribution of various pests, for example as to whether certain forest pests in Canada are introductions, either by natural immigration or by man, from Europe or whether they are of holoarctic origin. Studies such as these, coupled with a detailed knowledge of the host plant-range of the pest and allied species, the distribution and host-range of the various members of the parasite and predator complex, provide a very much sounder foundation for selection of biological agents for introduction than has been possible in the past. This is exemplified in Dr. Zwolfer's comparison between the parasite complexes of *Choristoneura fumiferana* and *C. murinana* in North America and Europe. Such work will become of increasing importance in the field of biological control.

273. This does not mean that the simple and rather empirical methods used in the past in biological control work will not still be used. They certainly will, for reasons of economy and practicability if for no other, and undoubtedly successful control of a number of pests will result from such work as has already occurred in the past.

274. There has been, again as a result particularly of the unforeseen effects of chemical applications to control various pests, a recent increased interest in the biological control of insects and other animals of medical importance, in which field comparatively little has been previously attempted (see Biological Control of Insects of Medical Importance, American Institute of Biological Sciences, Technical Report, November, 1960).

275. With respect to weed control the most outstanding example in the past three years has perhaps been the degree of control exerted on *Lantana* in Hawaii by the moths *Hypena jussalis* (from Africa) and *Syngamia haemorrhoidalis* (from Central America). Attempts to control *Lantana* biologically have been made over a period of many years in various parts of the world with no really spectacular success. Certainly the present situation in Hawaii offers encouragement for more effective biological control of this weed in a number of areas in the future.

276. Spectacular control has also been obtained in Nevis, West Indies, of some *Opuntia* spp. troublesome in pastures, by means of *Cactoblastis cactorum* (obtained from South Africa where it was introduced from Australia, its area of origin being Argentina). *O. triacantha*, the most noxious of these species, is now under complete control and in view of the results achieved *Cactoblastis* has also been introduced into Antigua and Montserrat, W.I.

277. Investigation on the value and use of insect pathogens has continued to expand. In August, 1958 the First International Congress of Insect Pathology and Biological Control was held in Prague with delegates from many countries of both the eastern and western blocs. This was of particular value in developing co-operation between workers in the two blocs, and as a practical result interchange of material of use in biological control work has continued since then. *Bacillus thuringiensis* is now marketed commercially for use as a bacterial insecticide against a number of lepidopterous pests. It has the advantage of being non-toxic to mammals, but is not particularly persistant and is not self-propagating. Research is being carried out on the possibility of producing other bacterial, virus and possible fungal preparations of a similar nature for

use as insecticides. Dr. Telenga in Russia has experimented with the use of sub-lethal doses of DDT coupled with a preparation of *Beauveria bassiana* against codling moth, with a view to minimising the disadvantageous effects of the chemical without reduction in the degree of control obtained. Further progress is being made with the use of pathogenic Nematodes, with and without accompanying pathogenic bacteria, as 'insecticides' against the Colorado beetle, codling moth, etc. It is too early to claim that these are as yet of practical value but results are promising. The effects of various synergists, including the effect of two or more pathogens acting together, on microbial control of insects are also being investigated.

278. There is still considerable, and possibly increased, interest in the use of mass-releases of parasites and predators at critical times in the season to control certain pests. Widespread use of *Trichogramma* in Russia against codling moth, cutworms, etc., is claimed to give good results. However, in Barbados, for many years one of the last strongholds of the use of this method against *Diatraea saccharalis*, data obtained over the past few years does not substantiate the value of this method and releases are being gradually discontinued.

279. In connection with the work on *Trichogramma* in Russia and also with that on other biological control problems far greater attention is now being paid to the exact biological characteristics of beneficial material selected either for introduction into a new area or for mass-release. More detailed studies of a number of parasite "species" used in biological control work (e.g. *Aphytis* spp. parasitic on scales—De Bach, 1960) have indicated the existence of several distinct species, with different potentialities as biological control agents, in material formerly thought to consist of a single species. Many extremely closely allied species of *Trichogramma* are used in mass-releases in Russia against different pests. Furthermore, greater consideration is being given to the existence and selection of geographical and biological races of various parasites with a view to obtaining the most efficient race for use under given climatic conditions against specified hosts (e.g. races of *Lixophaga diatraeae* and *Paratheresia claripalpis* against *Diatraea* spp. in various areas). As a development of this there is the possibility of breeding parasite or predator material with definite characteristics, e.g., host preferences, temperature and humidity tolerances, etc. This is also being investigated, but it would appear that this concept should be approached with a certain degree of caution.

280. In so far that biological control is, as mentioned above, essentially of practical application it is appropriate to report here some of the successes achieved in the past few years. The coconut scale, *Aspidiotus destructor*, has been completely controlled by means of the Coccinellid *Cryptognatha nodiceps* shipped from our West Indian Station to the island of Principe, Portuguese West Africa, where the scale had caused a reduction of copra production to 30 per cent of normal. The same pest was recorded for the first time in Jamaica in 1957 and although both *C. nodiceps* and *Azya trinitatis* have been successfully introduced from Trinidad it is uncertain as yet to what extent they are assisting in the control of the pest. *Eretmocerus serius* sent from Jamaica has given complete control of citrus black-fly in the Seychelles. *Aparteles circumscriptus* introduced from Europe to New Zealand has given spectacular control of the oak-leaf miner, *Lithocolletis messaniella*. In Bermuda *Cryptolaemus montrouzieri* and *Azya luteipes*, introduced in 1956 and 1957 from our West Indian Station, are giving some control of the scale *Pulvinaria psidii*. In Bermuda too the predacious snail *Englandina rosea* (from Hawaii, originally from Cuba) is established and apparently causing reduction in numbers of the snail *Otala lutea* in some areas. In the same island the nymphal parasite *Carabunia myersi* from Jamaica, introduced against the leaf-hopper *Clastoptera undulata* is established, but its effectiveness is at present unknown.

281. The success with *Cactoblastis* against *Opuntia* spp. in Nevis has already been mentioned above, as has the progress in control of *Lantana* in Hawaii. *Tetraeuaresta obscuriventris* introduced into Fiji from the West Indian Station against the weed *Elephantopus mollis* has developed extremely large populations, but whether it is exerting any control on the weed had not as yet been ascertained. *Sciomyza dorsata* (from Cuba) has given very satisfactory control of the liver-fluke snail *Lymnaea* sp. in some areas in Hawaii.

282. It is obvious that biological control is still a very promising method of destruction of both insect and weed pests and with the more recent developments it is likely to prove more effective and of wider application in the future.

Dairy Science and Technology

283. *Bulk milk collection.* The system of collecting milk in bulk rather than in cans, involving the use of bulk tanks on the farm and pumping the milk from these tanks directly into large road tankers, is continuing to expand in many parts of the world.

284. The pioneers of bulk milk collection, the United States continue to show the greatest degree of expansion and in January, 1960, no less than 140,793 bulk tanks were installed on American farms, representing an increase of 20·2 per cent. over the 1959 figure. The volume of milk collected under some of these schemes is so large that the

direct transport of milk from farm to dairy is no longer feasible and in one such scheme (*D.S.A.*, *22:* 2505) a bulk milk reloading plant operated by one man and capable of handling up to 21,000 gal. milk daily, has been introduced.

285. In Great Britain, Scotland continues to lead the way with bulk milk collection (*D.S.A.*, *22:* 956). Various Continental countries have reported the introduction of bulk milk collection schemes for the first time and the developments of several interesting modifications have been reported, which are designed to suit particular local conditions. For example, poor approach roads on farms in parts of Germany and Austria have resulted in 'compromise' schemes in which farmers still fill their milk into cans and take them to a central collecting point from where they are collected by specially designed bulk tankers. Such tankers have been described both in Austria (*D.S.A.*, *22:* 957) and Germany (*D.S.A.*, *23:* 100, 101). In another modified bulk milk collection scheme reported from Germany, milk is transported in cans to a standardized milk collecting depot where it is weighed in, cooled and stored in tanks until collected by bulk tanker from the dairy. Bulk milk handling appears also to have been introduced in the U.S.S.R. where a farm bulk tank has been described (*D.S.A.*, *22:* 64).

Economic aspects of bulk milk handling as opposed to can handling have been studied in several parts of the United States (*D.S.A.*, *22:* 2214; *22:* 967; *22:* 2836; *22:* 2215; *22:* 695), while bacteriological aspects of bulk milk handling and collection have been the object of investigation in Scotland (*D.S.A.*, *22:* 2606), Canada (*D.S.A.*, *22:* 2883) and the United States (*D.S.A.*, *22:* 2884; *22:* 2003).

286. *Heat pumps in dairy farming and dairy processing.* On dairy farms, where there is an ever increasing demand for adequate supplies of hot water for washing and sterilizing utensils as well as for refrigerants for cooling milk, the idea of producing both hot water and refrigerant from the same power unit is obviously an appealing one. Such units are now becoming available. Basically, they are modified refrigerators in which the heat normally dissipated by the condenser of the refrigerator to the atmosphere is used for heating water. An experimental unit of this type adapted for dairy farm use was first described over 12 years ago (*D.S.A. 11:* p. 6). More recently, American workers have described similar units for bulk milk cooling and water heating (*D.S.A.*, *21:* 797) and for farm dairy water heating (*D.S.A.*, *23:* 85). Whilst these were essentially experimental set-ups, the development of a commercial heat pump unit specifically for dairy farm use has been reported from Austria (*D.S.A.*, *23:* 361).

The heat pump principle has also been adapted successfully for the processing of milk in dried milk manufacture in the United States.

287. *Aseptic packaging of milk.* Commercial processes for the Ultra High Temperature heat treatment of milk are now available, which are capable of producing a virtually sterile milk which closely resembles fresh milk in both flavour and appearance, and which loses relatively little of its nutritive value compared with milk processed by the older in-bottle sterilization processes. The full benefits of these Ultra High Temperature processes will, however, not be realised until such milk can be filled into sterile containers under aseptic conditions. At present U.H.T. treated milk must receive a second heat treatment in order to destroy any contaminants from the bulk bottle or the atmosphere during bottling.

288. Several American Patents have been concerned with the aseptic filling of foods such as milk in glass containers (*D.S.A.*, *21:* 2754; *21:* 2753; *21:* 2752). More recently, the possibility of using pressurized steam for sterilizing milk bottles and incorporating such treatment in a modified bottle washer have been studied in Great Britian (*D.S.A.*, *23:* 337) while other studies have been concerned with the sterilization of milk bottles between the bottle washer and the bottle filler by ultra-violet rays (*D.S.A.*, *23:* 338).

289. The aseptic filling of milk into containers other than glass would overcome the problem of breakages and a report from Canada describes a commercial process of producing sterile aseptically packaged milk in Tetra Pak containers, superheated air being used for sterilization purposes (*D.S.A.*, *21:* 2179).

290. *Buttermaking.* While it is probably true to say that continuous buttermaking processes have not met with the same success in the major dairying countries as continuous manufacturing processes developed for other dairy products, work in this field has continued in several countries and it is quite possible that a process of continuous buttermaking will eventually be developed which proves acceptable to the major butter-producing countries.

291. An entirely new continuous buttermaking process was developed in Czechoslovakia some years ago (*D.S.A.*, *19:* p. 634). More recently, satisfactory test results with this machine have been reported (*D.S.A.*, *21:* 969, 1285). The machine consists essentially of a power driven rotor enclosed in a vertical fixed cylinder, the rotor having a number of discs each of which is positioned close to and partly overlaps a correspondingly stationary disc fixed in the inside of the cylinder. These two discs form a churning element and are provided with beating ribs. In operation, cream flows through a

central inlet at the top on to the uppermost disc, is forced by centrifugal force through the narrow clearance in the first pair of discs, and then continues its downward flow through successive pairs of discs, butter granules being formed in the process.

292. The Fritz process is one of the oldest and most successfully established of continuous buttermaking processes but its full utilization in the past has been limited to some extent by the fact that it could only churn sweet cream into butter. However, a recent report from Germany (*D.S.A.*, *21:* 1284) has described attempts to modify the Fritz process with a view to adapting it for churning ripened cream. These attempts appear to have been successful, as a modified Fritz machine was subsequently constructed and tested under factory conditions (*D.S.A.*, *22:* 1841).

293. A Westphalia machine has been similarly modified for churning ripened cream (*D.S.A.*, *22:* 944), and even the Alfa continuous buttermaking process, which works on an entirely different principle from the others, has been modified successfully for ripened cream (*D.S.A.*, *22:* 2140). A good review of the work leading up to the modification of existing continuous buttermaking machines for the processing of ripened cream has also been published (*D.S.A.*, *22:* 2139).

294. *Cheesemaking*. In the field of cheesemaking, much of the interest has continued to be centred on the mechanization of the cheesemaking process with a view to reducing the labour costs and obtaining a more uniform quality of cheese. A continuous method of milk coagulation and curd production inside a tube has been described in an American patent (*D.S.A.*, *22:* 2445). In principle, the process involves the passage of milk, containing rennet and starter culture, through a coagulation tube to allow the milk to ferment and coagulate with a minimum degree of agitation. The cheese curd formed is ultimately forced out of the coagulation tube, passes through a wire screen and is cut into ribbons which are further subdivided into cubes by a rotating blade.

295. Equipment to convert the tedious Cheddaring operation in Cheddar cheesemaking into a truly continuous process has been developed at the National Institute for Research in Dairying at Shinfield. The equipment consists essentially of a vertical metal cylinder made to taper outwards from top to bottom. The cylinder is so designed that Cheddaring takes place as the curd passes through from top to bottom where it is removed by a rotating cutterblade.

296. The well-known work on the mechanization of the Cheddar cheesemaking process, carried out at the Dairy Research Section of C.S.I.R.O. in Melbourne, Australia, has also made further progress, and a fully automatic plant for milling, salting and hooping curd is now in operation on a commercial basis (*D.S.A.*, *23:* 976, 977). The relatively straight forward process for manufacturing the Dutch cheese varieties lends itself more readily to mechanization than the Cheddar cheesemaking process, and important progress in the mechanization of Edam cheese manufacture has been reported from two Dutch cheese factories (*D.S.A.*, *22:* 637; *23:* 652).

297. The development of a continuous curd prepressing machine has also been reported from the Netherlands (*D.S.A.*, *21:* 1344).

298. Interest has also been centred on the development of new cheese varieties and cheese products during recent years, the advent of supermarkets and self-service stores, coupled with the progress made in packaging techniques, having created new markets for such products.

299. A new cheese variety known as Kernhem, a soft, surface-ripened cheese of cylindrical shape, was developed at the Netherlands Institute of Dairy Research (*D.S.A.*, *21:* 313). Another new cheese variety, also developed in the Netherlands, combines the characteristics of Gouda and Limberg cheese (*D.S.A.*, *21:* 1543). In the United States, 'Dariworld' cheese, developed at the University of Wisconsin (*D.S.A.*, *21:* 36) is claimed to be a mild flavoured, smooth-textured cheese of good keeping quality while an Australian attempt to combine the better properties of Cheddar and Edam cheese in the form of a new variety, 'Cheedam', has been described from Australia (*D.S.A.*, *20:* p. 645).

300. *Dried milk*. While earlier work on processes for producing instantly soluble milk powders have been largely confined to skim-milk, two new processes, developed in the United States, appear to be applicable to the drying of whole milk and are therefore of special interest. The first of these, reported from the Eastern Regional Research Laboratories, (*D.S.A.*, *20:* p. 302) is an adaptation of the puff-drying technique used in the drying of heat-sensitive citrus juices and other foods. It involves homogenizing, pasteurizing and concentrating milk, bubbling nitrogen through the concentrate, and drying the resulting foam in a vacuum shelf drier. The second process, reported from the Western Regional Research Laboratories (*D.S.A.*, *22:* 53), is known as foam-mat drying and also involves whipping a milk concentrate into a foam, air-drying it to form a porous sheet and finally breaking it up into powder.

301. A number of recent American patents have also been concerned with various aspects of manufacturing milk powders of increased solubility (*D.S.A.*, *22:* 2781; *22:* 2782; *22:* 1856; *22:* 1214).

Helminthology

302. During the past three years helminthological literature, covering as it does parasites of animals and plants has continued to grow in extent and complexity. Many new discoveries of potential interest have been reported but their validity and actual value to the agricultural community must await the results of further tests before they can be definitely accepted and confidently applied. As to be expected much work has been directed towards the search for new anthelmintics against infections occurring in animals and man, new nematicides against eelworm parasites of plants and compounds which would be effective in eliminating those molluscs which are important as vectors of trematode diseases, particularly fascioliasis in domestic ruminants and schistosomiasis.

303. *Anthelmintics.* Interest has been stimulated in the use of several organic phosphorus compounds against gastro-intestinal nematodes in cattle and sheep and a number of these show considerable promise but their potential toxicity has not yet been sufficiently assessed to warrant their widespread use. Methyridine has recently been found to be very active against intestinal nematodes in sheep. Bephenium embonate and hydroxynaphthoate have lived up to the expectations reported in these notes three years ago and have continued to show a high efficacy against *Nematodirus* in sheep; these compounds have now been shown to be effective against hookworm in dogs and allied species in man. The use of hygromycin B against nematodes in pigs and poultry has become more general and it has been tested against the fringed tapeworm in sheep. In some instances contradictory results have been reported recently on the efficacy of cyanacethydrazide against lungworms in ruminants, although this compound initially showed such good results that it was mentioned in our Notes of Progress in the 29th Annual Report as one "which may prove to be the most important contribution of recent years". Hexachlorophene and difluorotetrachlorethane are claimed to show promise against fascioliasis and dichlorobutane-chlorobutene against *Carmyerius dollfusi*, an amphistome of which the immature stages are highly pathogenic in zebu cattle.

It is disconcerting to learn that a strain of *Haemonchus contortus* in sheep has developed resistance to phenothiazine.

304. *Nematicides.* In the field of phyto-nematology there has been an increasing awareness of the devastating effects which eelworms can have on crop plants. In further search for nematicides dichlorophenyl-diethyl-phosphoro-thioate shows promise and exhibits low phytotoxicity, mercury compounds have been found effective against potato-root eelworm, 0,0-diethyl-0-2 pyrazinyl phosphorothioate appears to be effective against stem eelworm, bromoacetates have been shown to be highly active against two free-living eelworms which are used as test organisms and are therefore potentially useful against species of economic importance. A novel method of approach is the synergising of nematicides by combining with them other chemicals which affect the hatching of the eelworms. Of particular interest was the discovery that species of marigold (*Tagetes*) have an extremely marked effect on certain eelworm populations, in the soil. The use of these plants as cover crops has been recommended and it has been shown that populations of *Pratylenchus coffeae* and *Meloidogyne javanica* in tea can be reduced in this way; some work on the isolation of the nematicidal principle has been described. *Asparagus officinalis* has also been shown to reduce eelworm populations and its root diffusate has a nematicidal effect.

305. *Molluscicides.* Little effective progress appears to have been made recently in this field. Extensive use of copper sulphate and sodium pentachlorophenate has proved disappointing in some areas. Acrolein, some antibiotics, copper pentachlorophenate and some organic phorphorus compounds have been tested. *Marisa cornuarietis*, a predacious ampullarid snail may exercise some biological control over *Australorbis glabratus*. It is stated that *Oncomelania nosophora* is beginning to show resistance to dinitro-o-cyclohexylphenol.

306. *Irradiation.* A new approach to control has been initiated by the discovery that the administration of irradiated larvae of the lungworm *Dictyocaulus viviparus* to cattle would confer an immunity in these animals. An irradiated larval vaccine is now on the market. It has, however, been pointed out that if vaccinated calves are exposed to sudden extensive infection they will become infected and may be carriers. The work is being extended to other zoo-parasitic nematodes but irradiation has been shown to be impracticable for the control of phyto-parasitic forms. It has now been claimed that ultra-sonic waves may destroy the cysts of *Trichinella* in pork.

307. *Resistance in Plants.* Another important aspect of phytonematology is the breeding of crop plants resistant to the various eelworm species. The following have been recorded recently: tomato strains resistant to root-knot (*Meloidogyne* spp.), lucerne varieties resistant to *Ditylenchus dipsaci* and *Meloidogyne* spp., potato lines resistant to *Heterodera rostochiensis*, kenaf resistant to *M. incognita* and *M. incognita* var. *acrita*, a new tetraploid red clover (Ulva) resistant to *D. dipsaci*, a new barley variety (Drost) to *H. major*, lima beans resistant to *M. incognita* var. *acrita*, tobacco resistant to *M. incognita* and *M. incognita* var. *acrita*, rye variety (Heertvelder) resistant to *D. dipsaci*, oat varieties to *D. dipsaci*, a wild

Lycopersicum resistant to root-knot, cowpea varieties resistant to root-knot, soya bean varieties resistant to *Heterodera glycines*, cotton resistant to root-knot and *Fusarium* wilt.

308. In contrast to this, strains of *Heterodera rostochiensis* capable of infesting hitherto resistant potatoes have been shown to be present in a number of localities in Britain and the Netherlands and potentially resistance-breaking strains of *H. schachtii*, the beet eelworm, have been demonstrated.

309. The nature of resistance in potato hybrids to *H. rostochiensis* and the inheritance of resistance to root-knot have been studied. In *Nicotiana tabacum* the latter has been shown to be governed by a single dominant factor or a block which behaves as a single factor. The differences in plant tissue reaction to *H. schachtii* in hosts and non-hosts has been studied.

310. *Reservoir Hosts and New Records of Economic Importance. Animals.* Many new host and geographical records have been reported. Amongst these a number are of particular interest. Two trichostrongyles, normally parasitic in the intestine of ruminants, have been found in the pancreas of sheep, goats and camels. *Schistosoma haematobium*, *S. mansoni* and *Heterophyes heterophyes* have been reported from sea-lions (*Zalophus californianus*); *S. mansoni* has been found to be not uncommon in dog-faced baboons (*Papio doguera*) in East Africa and probably forms a reservoir of the infection in man; this species has also been found occurring naturally in various mammals in South America, unidentified schistosomes with eggs identical with those of the species occurring in man have been found in sheep, goats and rodents in Africa; *S. bovis* has been reported from a dromedary. *Spirocerca lupi* of the dog has been found in a premature newborn child. *Nematodirus battus*, *Trichostrongylus vitrinus*, *Marshallagia marshalli* and *Ostertagia ostertagi* have been recorded in cattle, *Cooperia punctata* and *Haemonchus contortus* in zebu cattle, *C. zurnabada* and *O. lasensis* in sheep, and a number of gastro-intestinal nematodes in buffaloes and llamas.

311. A focus of paragonimiasis in man has been discovered in Thailand, *Eucoleus annulata* has been reported in fowls in Czechoslovakia, *Trichonema alveatum* in the horse in India, *Cooperia spatulata* in cattle in the U.S.A., *Gastrothylax crumenifer* in cattle in Russia, *Paramphistomum cervi* in sheep and *Thysaniezia giardi* in sheep, goats and cattle in Turkey, and *Cooperia* spp. in sheep and cattle in Yugoslavia.

312. *Reservoir Hosts and New Records of Economic Importance. Plants.* The host and geographical range of many eelworms has been extended. Root-knot nematodes (*Meloidogyne* spp.) have been found attacking a very large number of new hosts in Australia, India and other parts of the world; an extensive host-list of these eelworms has been compiled for the Federation of Rhodesia and Nyasaland. A race of *Ditylenchus dipsaci*, the stem nematode, has been found to attack wheat in Italy; there is now a very considerable number of host races of this parasite. A species of *Nacobbus* has been found, for the first time in Europe, attacking tomatoes in Britain.

313. *Pathogenicity.* (*a*) *Animals.* Experimental evidence indicates that there may be a significant change in the tryptophan metabolism of the host during a *Trichinella* infection; subclinical nematode infections in sheep cause a depression in growth weight and poorer wool production; *Toxocara canis* larvae and possibly other ascarids from domestic animals, especially pet cats and dogs have been proved to provoke visceral larva migrans in man—a disease which is particularly serious in children—and also in pigs; *Brugia* (formerly *Wuchereria*) *malayi* has been shown to be transmissible from various animals to man and vice versa and *B. pahangi* has been proved potentially infective to man; *Schistosoma bovis* causes a 'knotted sclerosis' of the liver of cattle in Somalia; mass mortality in trout has been caused by *Crepidostomum*; filariids, probably of animal origin, have been implicated as causal organisms of tropical eosinophilia in man; a new species of *Stephanofilaria* causes ear sore in buffalo in India; swine lungworms appear to form a reservoir for swine fever, the virus remaining masked until activated by stress; *Onchocerca* sp. has been shown to provoke skin lesions in horses; Newcastle disease virus has been isolated from *Ascaridia galli*.

(*b*) *Plants. Pratylenchus penetrans* is associated with peach replant disease and the loss of cold hardiness in cherry; *Radopholus similis* is implicated in blackhead disease in banana; various eelworms are associated with seedling injury in forest nurseries; *P. vulnus* is associated with the hairyroot bacteria in causing disease in rose crops; *Meloidogyne exigua* is an important pest of coffee in Brazil; *P. brachyurus* is a serious pest of peanuts; *Xiphinema index* has been shown to transmit fan-leaf virus in vine—the first record of an eelworm transmitting a virus—and *Xiphinema* sp. to transmit arabis mosaic virus, raspberry yellow dwarf strain raspberry, strawberry and white clover. *Mononchus* sp. is suspected of causing decline of Mandarin oranges in South India; a new species of *Hoplolaimus* has been found attacking banana in Tanganyika; *Rotylenchus reniformis* is associated with poor growth in cotton; *P. scribneri* is associated with a disease of *Cymbidium* orchids; *Meloidogyne arenaria* has been found infesting potatoes; various eelworms cause disease in spruce seedlings.

314. *Immunology.* There has been considerable work on the production, isolation and use in immunological diagnosis of antigens from various helminths. In general there seems to be no protective effect associated with the presence of complement fixing antibodies. Ascarid antibodies have been shown to pass in the circulating blood, and subsequently in the milk from mothers to offspring in man and rabbits. Research continues on the stimulation of immunity by the administration of initial doses of infective forms and on the mechanism of the immune responses evoked, especially the self cure phenomenon. With *Haemonchus contortus* the second ecdysis appears to stimulate immunity and the exsheathing fluid is antigenically important. Of interest also is work on the retardation or inhibition of larval development caused by host immunity. Metabolic products in culture media have been shown to be highly antigenic.

315. *Economic Losses.* The economic loss caused by helminthic diseases is difficult to assess but the following figures have been quoted:

In East Germany the damage done in sheep alone by liver-fluke, gastro-intestinal nematodes and lungworms costs annually about 10 million DM;

In the Netherlands the loss caused by *Cysticercus bovis* in cattle has risen to one million guilders annually;

In Belgium the annual loss caused by *Cysticercus bovis* in cattle is estimated to be 25,000,000 Belgian francs;

In Australia carcass condemnation solely on account of hydatid does not exceed £600,000 annually;

In the U.S.A. root-knot nematodes (*Meloidogyne* spp.) are estimated to cause a total annual loss of 1·13 per cent. of the of the cotton crop.

316. *Miscellaneous.* Work continues on the chemical nature and effects of various root diffusates on the hatching of eelworms. Isotope-labelled anthelmintics have been used to study the uptake of the chemical by the parasite. The sulphur analogue of tartar emetic, used against schistosomiasis, is claimed to be fifty times less toxic than tartar emetic without loss of efficacy. The relationship between human and simian *Loa* has been studied. Fish helminths, particularly monogenetic trematodes, are being increasingly recognized as of importance where fish farming programmes are under way and there has been an extensive study of the digenetic trematodes of the Salmonidae. The use of a nematode with its associated bacterium is being investigated as a possible means of control of the Colorado potato beetle.

Many accounts of newly worked out life-histories and descriptions of forms new to science have been published.

317. *Publications.* A number of important new books have appeared including:

Skryabin, K. I. "Trematodes of animals and man. Principles of trematodology." (In Russian.) Volumes 14, 15, 16, 17 and 18.

Popova, T. I. "Principles of nematology edited by K. I. Skryabin. Volume 7. Strongyloidea of animals and man. Trichonematidae." (In Russian.)

Popova, T. I. "Principles of nematology edited by K. I. Skryabin. Volume 8. Oxyurata." (In Russian.)

Yamaguti, S. "Systema helminthum." Volumes 1 and 2.

Kotlán, A. "Helminthologie. Die Helminthosen der Haus-und Nutztiere unter Berücksichtigung der Helminthosen des Menschen."

Tarjan, A. C. "Check list of plant and soil nematodes. A nomenclatorial compilation."

New periodicals which have been issued include:

Parassitologia, Rome.
Research in Veterinary Science, London.

Horticulture and Plantation Crops

318. *Introduction.* The field of horticulture and plantation crops is a very large one. Since notes of progress were prepared three years ago some 17,500 papers have passed through the mill. Clearly, within the confines of 3 or 4 pages anything in the nature of a full coverage would be little more than an undigested and indigestible list of headings. The procedure adopted in the last triennial notes of progress has therefore been repeated, in that only a few topics have been selected for discussion in modest detail. With few exceptions these topics differ entirely from those discussed three years ago. This should not be taken to mean that the subjects mentioned in the earlier report are no longer of importance.

319. *What is progress?* In an economic study of glasshouse tomato production in Britain (*H.A., 28:* 485)* it is pointed out that over a 10-year period ending in 1953 there were no significant increases in the average yield per acre. Yield per acre is not of course the only criterion by which progress can be measured, but it is certainly an important one. Nor are figures of yield per acre from one year to another always strictly comparable. The fact remains, however, that the apparent lack of progress in this particular tomato industry should give grounds for disquiet. This is all the more so, because there are few horticultural crops on which more research is being done than the tomato, and there can also be few growers better placed to apply the results of

*Refers to *Horticultural Abstracts,* Vol. 28, Abstract No. 485.

research than those with glasshouses in which environmental factors can be closely controlled.

320. What then, if anything, has gone wrong? The examination of an immense amount of literature suggests that two trends are becoming more pronounced each year, which, taken together, may impede the application of the results of research work.

321. In the first place it would seem that the approach to horticultural research is gradually changing. Instead of the crop occupying the central position, the emphasis has been shifting towards subjects. Whether or not this is the inevitable result of specialization, the fact remains that it is becoming increasingly difficult to connect together the results of different pieces of research in a way that makes it possible to use them to the benefit of crops. Although this work is often excellent in itself, it is doubtful if our predecessors would have applied the adjectives 'agricultural' or 'horticultural' to much of it.

322. A second trend, possibly connected with the first, is to place increasing emphasis on the accumulation of data and proportionately less emphasis on its collation and synthesis. Even where reviews are produced, the tendency is to concentrate on subjects rather than crops, the latter being often relegated to the role of test plants. In particular, facilities for reviewing work on crops done in other countries would seem to be most inadequate, and as often as not the only sources now open to the grower are rather sketchy and sometimes inaccurate articles in the trade press.

323. *Rainfall, humidity and temperature.* Surveys to determine the relationships between rainfall (both quantity and distribution) and crop yields are not new, but the number of crops subjected to such surveys has increased in recent years. Among the crops surveyed in this way are blackberries, cacao, grape vines, oil palms, sugar cane, tea and tobacco. Some of the correlations recorded are sufficiently striking as to suggest that surveys of this type would be of value, not only in deciding on the need for irrigation schemes, but also for determining the suitability or unsuitability of new areas for development in particular crops. (*H.A.*, *28:* 846, 889, 945, 3443; *30:* 3958, 4467, 5006, 6212.)

324. Amongst various climatic factors relative humidity receives comparatively little attention. Yet the few experiments reported on the effects of relative humidity have shown that these can be both drastic and unexpected. (*H.A.*, *29:* 21, 38, 539; *30:* 1889.)

325. Many papers describe the responses of plants to air and soil temperatures, but none goes so far as one which attempts to interpret all the life processes of plants in terms of temperature sums. (*H.A.*, *30:* 4905.)

326. *The uniformity of clonal material.* In horticulture, both commercial and experimental, the use of clonal material is particularly widespread. It used to be thought that once a superior variety or rootstock had been reproduced vegetatively as a clone, this clone would maintain its uniformity from generation to generation. It is now apparent, however, that there are several ways in which clones may lose their uniformity.

327. In the first place it has been demonstrated that clones may age in the physiological sense. Citrus varieties have proved particularly suitable for investigation of this problem, because many of them can be propagated "true-to-type" both from polyembryonic seeds and by budding. This has provided clear evidence that nucellar seedling or new-line strains differ in various respects from their parent or old-line clones. Comparisons between budded trees of both old- and new-line strains have shown that these differences may be perpetuated in successive generations. (*H.A.*, *28:* 4002, 4003; *29:* 1792).

328. A second source of variation in clones is the appearance of mutants. This phenomenon is well known, particularly in the development of red sports of apples, but it would now seem to be more widespread than had been suspected and to involve the appearance of strains virtually indistinguishable from their parents in other important respects. One such example in pears is described elsewhere in these notes. Investigations on strains selected from strawberry and orange varieties afford other examples. (*H.A.*, *29:* 2205; *30:* 1128.)

329. The presence of viruses provides another possible source of variation. One outstanding example of a virus, which merely depresses growth and may cause marked lack of uniformity in clonal material without producing any obvious symptoms of ill-health, is the ratoon stunting disease of sugar cane. This disease and its control by heat therapy continue to receive much attention, and the same can be said of the work, mentioned in the last triennial notes of progress, on the identification and elimination of many other viruses now found in clonal material of many plants.

330. Finally, when every precaution has been taken to ensure that planting material is genetically uniform and free from all known virus diseases, there is still a risk that plants may never recover fully, and hence grow uniformly, if mistakes are made at the time of planting. (*H.A.*, *29:* 863, 1888; *30:* 2878.)

331. *The propagation of plants from cuttings.* In the notes of progress published three years ago particular emphasis was laid on the development of

'mist propagation' as an aid to the rooting of soft-wood or semi-hardwood cuttings. Since then this method has been widely adopted both by research stations and commercial nurseries, which probably accounts for the exceptional demand for a review on the subject issued by the Bureau at the beginning of 1960 (*Digest* No. 2).

332. It should be emphasised, however, that the use of mist in propagation houses or frames only provides a measure of control of one of the factors that affect the survival and rooting of cuttings, namely the humidity of the air and leaf surface. Many other factors, both in the plant material used for cuttings and in the environment provided, contribute to success or failure. In the rush to instal mist units these other factors may sometimes have been overlooked.

333. One factor of obvious importance is light. With some woody plants, for example, the provision of long photoperiods may improve rooting during the usual season for propagation, make rooting 'out-of-season' practicable or aid establishment after cuttings have rooted (*H.A.*, *28:* 3972, 3982, 3991). Carnations also may root better in long than in short days, but best of all if the parent stock plants, from which the cuttings are taken, are growing under short-day conditions (*H.A.*, *30:* 5807). Other plants, such as yew, may root better under short photoperiods, though, curiously enough, only if the pH of the rooting medium is high (*H.A.*, *29:* 2676). Not only day length, but also light intensity affects rooting. One of the advantages of mist propagation is that it lowers the temperature of the leaf surface and thus makes it possible to provide somewhat higher light intensities without the risk of scorching. However, not all types of cutting favour exposure to full sunlight (*H.A.*, *30:* 4554). Light intensity, like photoperiod, is also liable to interact with other factors influencing rooting (*H.A.*, *29:* 2061).

334. It has for long been known that the air-moisture-temperature relations of the rooting medium have a profound effect on the survival and rooting of cuttings. Recent work serves once again to emphasize this (e.g. *H.A.*, *28:* 653, 3923, 3924), but there still seems to be a marked reluctance on the part of research workers to investigate the problem systematically, and in particular to take adequate account of the physical characteristics of the medium (particle size, porosity, water-holding capacity) in so far as these affect callusing and root formation and emergence.

335. In addition to the rooting environment the morphology and physiology of the parent plants from which cuttings are taken and the treatments these plants receive are obviously of great importance. To the plant propagator plants are classed as shy-rooting or free-rooting. Recent anatomical studies on shoots of two trees, the olive and the apple, suggest that basic rooting ability depends on the structure of tissues in the outer part of the stem (*H.A.*, *30:* 1197, 4907).

336. It is generally recognized that plants in a juvenile or vegetative condition yield cuttings that root more readily than plants in an adult or generative condition. Methods designed to exploit this knowledge have been evolved for such diverse types as avocado pears, apples, cinchona and hevea rubber (*H.A.*, *28:* 755, 2163, 2791, 3112; *29:* 2994; *30:* 1091). It seems probable that even in mature, fruiting trees certain tissues or buds in the region of the bole remain juvenile and are capable of giving rise to shoots possessing juvenile, and hence free-rooting, characteristics. It would of course represent a considerable advance if it could be demonstrated that in all dicotyledonous woody plants the bole was the only substantial 'reservoir of juvenility' (other than abnormal structures such as sphaeroblasts). Hitherto one obstacle to general acceptance of this theory has been the production by many species of apparently juvenile suckers from roots growing at considerable distances from the bole. Now, however, it has been shown that, in plums at least, these suckers are produced on special roots which arise at or very near to the bole of the tree (*H.A.*, *28:* 1104).

337. *Rootstock-scion incompatibility.* Lack of compatibility between certain rootstock-scion combinations is one of the oldest horticultural problems. In those cases where the degree of incompatibility is so high that no union occurs between stock and scion the answer to the problem is quite simple; either the combination is abandoned or an inter-stock compatible with both the partners is inserted between them. In other cases incompatible combinations do form a union and may grow apparently normally for many years. Where this happens it is commonplace to find trouble developing when the trees start bearing. To the fruit grower this causes serious losses and to the research worker studying the effects of rootstocks on scion growth it adds confusion to an already complex problem. Clearly, it would represent a considerable step forward if the factors responsible for incompatibility could be identified in the stock and scion components before they have been grafted, or if the existence of incompatibility could be confirmed at an early stage in the development of the grafted tree without taking the drastic step of cutting it down to examine the anatomy of the union.

338. Two papers suggest ways in which incompatibility might be forecast in advance of grafting. One, on holly, relates incompatibility to differences in chromosome size (*H.A.*, *28:* 2937). Another, concerned with pears grafted on quince rootstocks,

attributes incompatibility to the production by quinces of a cyanogenetic glucoside, prunasin, which is conducted into the phloem tissues of the pear where it decomposes to form hydrocyanic acid, which in turn destroys the phloem just above the union. The extent to which this occurs appears to be linked with the ability of pear bark to decompose amygdalin and also, in the grafted tree, with the distance from the union at which prunasin may be detected in the bark (*H.A.*, *29:* 94). Again, when pear has been worked on quince, the development of abnormalities in the secondary phloem of the roots may be indicative of incompatibility (*H.A.*, *28:* 3314). Finally, in trees of apricot on peach stocks the simplest, and least destructive, of several methods of detecting incompatibility is to measure the degree of tissue discontinuity in a strip of bark tissue (*H.A.*, *29:* 3228).

339. As to the factors responsible for incompatibility several suggestions have been made. In contrast to the paper mentioned above which placed the blame on prunasin produced by quince rootstocks, two other papers, one on citrus and the other on papaws, suggest that substances produced by the scion may be toxic to the rootstock (*H.A.*, *29:* 791; *30:* 2935). A third paper, on cucurbits, attributes the trouble to the failure of the scion to produce a substance vital to the rootstock (*H.A.*, *28:* 425).

340. If the emphasis in these brief notes seems to be mainly biochemical and anatomical, it should not be forgotten that there is also a genetical aspect. In a study of the pear Williams' Bon Chrétien (Bartlett) on the clonal Quince A rootstock, three superficially identical strains of Williams' have been identified, one of which is compatible with this quince, one slightly incompatible and one wholly incompatible (*H.A.*, *29:* 2115).

341. *Plant nutrition.* Plant nutrition is a subject which could be approached from many directions, but it is proposed here only to examine one of them, and that very briefly. For convenience the aspect chosen might be described as "the problem of phasic variation in the nutrient requirements of plants". Examples of such variation are available from a very wide range of plants. Thus with tobacco plants nutrient needs appear to be low for some 6 weeks after transplanting but then to increase markedly (*H.A.*, *29:* 582). With tomato plants two periods of accelerated nutrient absorption have been identified (*H.A.*, *30:* 779). With onions the demand for nitrogen appears to increase, and that for phosphorus and potash to decrease, during growth (*H.A.*, *30:* 2280, 2282). With hemp (*Cannabis sativa*) male and female plants differ in the time at which their need for potash is greatest (*H.A.*, *28:* 2803). With perennial crops there are variations in the content of different nutrients both within and between seasons (e.g. *H.A.*, *28:* 1132; *29:* 2139, 2818, 3056, 3259; *30:* 199).

342. It will be readily appreciated that fluctuations in nutrient absorption or in the content of nutrients in different plant organs will have a bearing on many other nutritional problems, such as the appearance and disappearance of nutrient deficiency symptoms, the interpretation of leaf analysis figures, the timing of fertilizer applications and their placement, etc. The position is further complicated by interactions between various elements and also by the fact that seasonal and other changes in environment, as well as changes in the plant itself, may influence the absorption and utilization of nutrients. Examples of environmental changes include the effect of day length on the absorption of nutrients by carnations (*H.A.*, *30:* 5808) and the effects of temperature and even of soil compaction on the absorption of phosphorus by various plants (e.g. *H.A.*, *28:* 745, 776, 1132).

343. Although the factors mentioned above may sometimes make it difficult to disentangle cause from effect, probably the main obstacle to making full use, in the biological sense, of data on variations in nutrient requirements is that they are only rarely linked with particular phases in the development of a plant. Thus it is commonplace to find changes in nutrient status recorded on a series of evenly spaced dates, but the reader is left to guess in what particular phase of growth the tree or plant may be on those particular dates. This would appear to be a case in which collaboration between chemist and botanist might be fruitful. Conceivably some general patterns in the utilization of nutrients by plants might then emerge.

344. *Growth substances.* No account of progress in research would be complete without mention of the gibberellins. Reference to them is made in no less than 373 papers abstracted in the last 3 volumes of *Horticultural Abstracts*. An astonishing number of different effects have been recorded, among them breaking of dormancy in seeds, substitution for vernalization, elongation of stems, parthenocarpic fruit set, improvements in the shape of bunches of grapes and improvements in disease resistance. And yet so far the promise shown has been infinitely greater than the fulfilment. As a result, if one excludes the non-horticultural use of gibberellins to improve the sprouting of malting barley, few practical uses for these intriguing compounds are yet in sight. One probable reason for this is that there are several different gibberellins which differ in their biological effects. Another is that there are so many possible responses that both the timing of treatments and the concentration used may have to be exceptionally precise if a particular desired response is to be obtained.

345. Coming second in prominence to the gibberellins is the growth inhibitor maleic hydrazide, with mention in a mere 77 papers in the past 3 years. This compound, which first came to notice more than 10 years ago, has proved of practical value in a variety of ways. Among these are the suppression of sprouting in stored onions, the prevention of premature growth in citrus trees that have been defoliated by frost early in the winter and reductions in the growth of hedges and therefore the labour of clipping. On the other hand, all is not yet plain sailing, as has been demonstrated recently in tobacco crops where undesirable side-effects have followed the use of maleic hydrazide to suppress sucker (i.e. lateral shoot) formation.

346. In contrast to the numerous problems that have arisen since the gibberellins and maleic hydrazide were first discovered, there is another group of chemicals that has recently come to the fore and almost immediately found at least one practical application. These are certain quaternary ammonium compounds, which shorten the internodes of plants and thereby make them more compact. This form of dwarfing has proved of value with certain ornamentals which tend to become leggy, and the only snag so far reported is that the compounds in question are apt to be very persistent in soil, thus affecting the crops grown in treated land for many years in succession. (*H.A.*, *28:* 2877; *29:* 2064; *30:* 1097, 5820.)

347. *Plant responses to plant protection chemicals.* Where a plant is sprayed with the wrong chemical or with the right chemical at the wrong concentration visible injury may result. When the effect is so clear-cut, both grower and research worker can take any steps necessary to avoid a repetition. What is much more disconcerting is the growing volume of evidence that many spray materials can affect the growth and metabolism of plants without producing any very obvious visible symptoms. It would seem likely that in some cases these masked effects are sufficiently large to confuse the results of investigations on other aspects of plant management and growth.

348. Apart from the expected effects of copper and zinc fungicides on the trace-element composition of plants (e.g. *H.A.*, *28:* 276), there are examples of the mineral composition of plants being influenced by insecticides, antibiotics and soil fumigants (*H.A.*, *28:* 1451; *30:* 2118, 2402, 4755). In the sphere of water relations there are examples of transpiration rates being reduced or increased by both fungicides and insecticides (*H.A.*, *28:* 1525; *29:* 827; *30:* 6161). Photosynthesis too may be affected by sprays, even by light insecticidal oils (*H.A.*, *29:* 2876, 2877). Finally, studies on apple fruits have shown that several compounds may have side-effects, some adverse and others beneficial, on fruit set, development and maturity (*H.A.*, *28:* 326-328, 2437; *30:* 248-250, 423, 516).

FINANCE

349. The Comptroller and Auditor-General has audited the accounts of the Bureaux, the Institute of Entomology and the Mycological Institute for 1960-61 and the account of the Institute of Biological Control for 1959-60. These accounts are attached to this report. The position as regards contributions on 31st March, 1961 was as follows:

(1)	Contributions due in 1960-61 (2)	Outstanding on 31.3.60 (3)	Total due (4)	Outstanding on 31.3.61 (5)	Total received in 1960-61 (6)
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bureaux	163,314 0 0	2,904 12 4	166,218 12 4	5,775 10 0	160,443 2 4
Institute of Entomology	47,475 0 0	844 5 0	48,319 5 0	1,636 2 0	46,683 3 0
Mycological Institute	41,778 0 0	742 5 0	42,520 5 0	1,438 17 0	41,081 8 0

NOTES:

(i) The figures in column (2) are those recommended by the Review Conference 1955 (page 48 of the report)

(ii) The figure of receipts in column (6) in respect of the Bureaux Fund is £152 more than the figure shown in the audited account on page 45 due to an advance payment for 1960-61 from the Colonial Territories received and credited in 1959-60 (see note (ii) page 41 of the 31st Annual Report). The figures for Entomology and Mycology agree with the figures shown in the audited accounts on pages 46 and 47 respectively.

(iii) The amounts of £6,028 13*s.* 5*d.* reported in note (iii) on page 38 of the 24th Annual Report and £915 5*s.* 0*d.* reported in note (iii) on page 36 of the 29th Annual Report were written off by the Executive Council at their 189th Meeting held on 7th December, 1960.

(iv) The outstandings in column (5) are from Pakistan, £4,389, Republic of the Sudan £3,192, Cyprus £1,138 1*s* 0*d.* and Colonial Territories £131 8*s.* 0*d.* Since the close of the year the contributions from Pakistan, Cyprus and the Colonial Territories have been received.

Commonwealth Institute of Biological Control

350. The audited account for the Institute of Biological Control attached to this report relates to the year 1959-60. The position as regards contributions at 31st March, 1960, was as follows:

	£	s.	d.
Amount due in respect of 1959-60 ..	43,044	0	0
Add arrears outstanding on 31st March 1959	233	15	0
	43,277	15	0
Deduct arrears outstanding on 31st March, 1960	764	16	0
Contributions received during year ..	£42,512	19	0

The outstanding amount on 31st March, 1960 has since been paid.

Notes:

(i) The figure of £42,517 15*s.* 0*d.* shown in the audited account on page 48 is £4 16*s.* 0*d.* more than that shown above due to this amount being received from the Colonial Territories for 1958/59 but not credited until 1959/60.

(ii) The amounts of £668 8*s.* 2*d.* reported in note (ii) on page 45 of the 25th Annual Report and £39 15*s.* 0*d.* reported in note (ii) on page 38 of the 30th Annual Report were written off by the Executive Council at their 189th Meeting held on 7th December, 1960.

351. The total expenditure between the Bureaux, Secretariat and Central Sales was as follows:

Commonwealth Bureaux:

	£	s.	d.
Animal Breeding and Genetics (Edinburgh)	20,397	2	5
Animal Health (Weybridge)	24,969	16	10
Animal Nutrition (Aberdeen)	19,111	10	7
Dairy Science and Technology (Shinfield)	18,880	0	3
Forestry (Oxford)	26,421	19	1
Helminthology (St. Albans)	21,511	6	9
Horticulture and Plantation Crops (East Malling)	24,249	9	6
Pastures and Field Crops (Hurley) ..	24,930	3	0
Plant Breeding and Genetics (Cambridge)	21,305	8	10
Soils (Harpenden)	24,352	13	10
Secretariat	20,821	16	1
Central Sales	18,440	19	8
Contribution to National Institute of Agricultural Engineering (Silsoe) ..	3,000	0	0
Contribution to World Agricultural Economics and Rural Sociology Abstracts	1,000	0	0
	£269,392	6	10

352. To make the expenditure of the Bureau of Animal Nutrition comparable with all the other figures, a sum of £14,635 18*s.* 0*d.* should be added to £19,111 10*s.* 7*d.* making £33,747 8*s.* 7*d.* This amount of £14,635 18*s.* 0*d.*, is taken from the separate audited account for NUTRITION ABSTRACTS AND REVIEWS and is the total of printing, distribution, administration and extra staff costs. These costs are included in the totals for other bureaux shown in the above table.

THE EXECUTIVE COUNCIL OF THE COMMONWEALTH AGRICULTURAL BUREAUX

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1961

RECEIPTS

	£ s. d.	£ s. d.
Contributions from Commonwealth and other participating Governments for:		
Commonwealth Agricultural Bureaux	160,291 2 4	
Various Institutes	123,218 16 0	
	283,509 18 4	
Less: Paid over to Institutes	123,218 16 0	
		160,291 2 4
Sale of publications		53,163 11 8
Reprinting for Institutess, etc.		1,645 6 5
Contributions from Institutes towards cost of Headquarters		3,000 0 0
Miscellaneous receipts:		
Dividends and Interest	7,013 8 8	
Other receipts	502 18 2	
		7,516 6 10
		225,616 7 3
Sale of part of Farnham House land		350 0 0
Repayment of Loans:		
Slough Borough Council		52,000 0 0
Proceeds of sale to Commonwealth Institute of Biological Control of part interest in loan of £25,000 to Cheshire County Council		8,000 0 0
Balance at 1st April, 1960		34,297 0 1
		£320,263 7 4

PAYMENTS

	£ s. d.	£ s. d.
Secretarys' and Assistant Secretary's Salaries		6,107 6 3
Consultant Directors' honoraria		945 0 0
Directors' and Assistant Directors' Salaries		51,212 9 10
Scientific Assistants' Salaries		65,593 13 0
Clerical and Technical Staff		49,603 3 4
National Insurance		3,043 1 3
Superannuation		16,090 15 1
Supplementation of Superannuation and Increases in pensions		1,226 16 9
Travelling expenses		1,541 1 9
Books, periodicals, etc.		2,114 15 10
Issue bulletins and periodical publications		42,719 14 8
Stationery, postage, telephones, etc.		7,021 14 5
Rent, maintenance, etc.		7,144 3 6
Contribution to National Institute of Agricultural Engineering		3,000 0 0
Grant to World Agricultural Economics and Rural Sociology Abstracts		1,000 0 0
Accounting charges and Audit fee		2,150 0 0
Miscellaneous Expenses		1,211 6 9
Furniture and equipment		4,105 3 2
Visits Overseas (outside Europe)		2,445 3 9
Review Conference		1,116 17 6
		269,392 6 10
Balances at 31st March, 1961:		
H.M. Paymaster General	18,540 4 7	
Post Office Savings Bank	4,811 17 3	
Treasury Bills—at cost	24,720 16 8	
Sub-Accountants and suspense	2,798 2 0	
		50,871 0 6
		£320,263 7 4

Investments at 31st March, 1961:

£		Cost £ s. d.	*Market value at 31st March, 1961* £ s. d.
2,000	Commonwealth of Australia 4% Stock, 1955-70	1,940 4 0	1,690 0 0
	Cheshire County Council loans:		
25,000	to 25th April, 1962 at 5⅝%	25,000 0 0	25,000 0 0
17,000	to 4th June, 1962 at 5½%	17,000 0 0	17,000 0 0
		£43,940 4 0	£43,690 0 0

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) T. V. SCRIVENOR, Secretary,
Executive Council, Commonwealth
Agricultural Bureaux.

I have examined the above account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
4th October, 1961.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1961

RECEIPTS

	£ s. d.	£ s. d.
Contributions:		
Commonwealth and other participating Governments	46,683 3 0	
Other Contributors ..	675 0 0	
		47,358 3 0
Sale of publications		16,488 12 8
Dividends and Interest ..		1,777 2 2
Administration Fees and Agency charges:		
Pool of Entomologists ..	200 0 0	
Termite Research Unit ..	75 0 0	
African Phyto-Sanitary Commission	1,750 0 0	
		2,025 0 0
		67,648 17 10
Repayment of Loan:		
Doncaster Corporation ..		5,000 0 0
Balance at 1st April, 1960 ..		16,124 17 4
		£88,773 15 2

PAYMENTS

	£ s. d.	£ s. d.
Directors' Salaries		6,135 6 3
Scientific Assistants' Salaries		35,797 14 5
Clerical and Technical Staff		10,776 0 1
National Insurance		880 16 6
Superannuation		4,816 17 11
Supplementation of Superannuation and Increases in pensions		1,478 2 0
Travelling expenses		209 0 1
Books, periodicals, etc.		462 16 2
Issue bulletins and periodical publications		9,206 19 11
Stationery, postage, telephones, etc.		1,068 19 3
Rates, insurance, maintenance, etc.		1,055 17 1
Lighting, heating, water, cleaning, etc.		590 19 2
Contribution to Headquarters, accounting charges and audit fee		1,594 19 6
Miscellaneous Expenses		142 14 9
Furniture and equipment		283 7 11
Commonwealth Entomological Conference		358 14 4
		74,859 5 4
Balances at 31st March, 1961:		
Crown Agents for Oversea Governments and Administrations	680 19 5	
Bank, petty cash and stamps	14 14 7	
Joint Consolidated Fund	12,000 0 0	
F.S.S.U. and Miscellaneous Suspense	1,218 15 10	
		13,914 9 10
		£88,773 15 2

(Signed) F. H. DAVEY,
Accountant to Council.
(Signed) T. V. SCRIVENOR, Secretary,
Executive Council,
Commonwealth Agricultural Bureaux.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
2nd October, 1961.

Investments at 31st March, 1961:

£ s. d.		Cost £ s. d.	*Market value at 31st March, 1961* £ s. d.
1,000 0 0	Cyprus 4% Stock, 1956/66	950 0 0	800 0 0
2,679 19 0	Funding Loan 4% Stock, 1960/90 ..	1,869 12 6	2,344 19 2
1,017 16 8	Kenya 4½% Stock, 1961/71	998 15 0	737 18 7
1,000 0 0	Nigeria 4% Stock, 1963	881 7 0	925 0 0
951 1 10	Savings 3% Bonds, 1960/70	1,040 5 2	751 7 3
3,000 0 0	N. Rhodesia 3% Stock, 1963/65	2,911 1 7	2,550 0 0
2,060 17 1	Savings 3% Bonds, 1955/65	2,126 15 1	1,875 7 7
1,013 18 2	Nyasaland 4½% Stock, 1971/78	1,000 13 3	623 11 1
		£11,778 9 7	£10,608 3 8

(Signed) E. O. PEARSON,
Director.

COMMONWEALTH MYCOLOGICAL INSTITUTE

Account of Receipts and Payments for the Year ended 31st March, 1961

RECEIPTS

	£ s. d.	£ s. d.
Contributions:		
Commonwealth and other participating governments	41,081 8 0	
Other contributors ..	100 0 0	
		41,181 8 0
Sale of publications		10,803 16 5
Sale of cultures		851 14 5
Rent of acquired property ..		1,195 18 0
Dividends and interest ..		2,099 19 9
Miscellaneous receipts ..		40 0 0
Administration Fees and Agency charges:		
Department of Scientific and Industrial Research	2,714 2 4	
Colonial Development and Welfare Scheme R1070..	62 8 11	
Pool of Plant Pathologists..	879 10 6	
African Phyto-sanitary Commission	1,750 0 0	
		5,406 1 9
		61,578 18 4
Instalment of contribution towards cost of building completed in 1955 ..		51 0 0
Balance at 1st April, 1960 ..		16,577 8 4
		£78,207 6 8

PAYMENTS

	£ s. d.	£ s. d.
Director's Salary		3,344 3 4
Scientific Assistants' Salaries		29,617 17 6
Clerical and Technical Staff		15,332 9 0
National Insurance		984 1 10
Superannuation		4,465 1 4
Supplementation of Superannuation and Increases in pensions		685 8 1
Travelling expenses		357 14 1
Books, periodicals, etc.		379 0 2
Issue bulletins and periodical publications		9,094 4 7
Stationery, postage, telephones, etc.		850 13 8
Rent, rates, insurance, maintenance, etc.		1,323 4 4
Lighting, heating, water, cleaning, etc.		2,766 7 11
Contribution to Headquarters, accounting charges and audit fee		1,536 8 5
Miscellaneous expenses		119 4 7
Furniture and equipment		1,696 16 3
Commonwealth Mycological Conference		156 16 4
		72,709 11 5
Balances at 31st March, 1961:		
Crown Agents for Oversea Governments and Administrations	800 16 6	
Bank, petty cash and stamps	616 6 7	
Joint Consolidated Fund	3,000 0 0	
F.S.S.U. and Miscellaneous Suspense	1,080 12 2	
		5,497 15 3
		£78,207 6 8

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) T. V. SCRIVENOR, Secretary,
Executive Council,
Commonwealth Agricultural Bureaux.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department.
4th October, 1961.

Investments at 31st March, 1961:

£ s. d.		*Cost* £ s. d.	*Market value at 31st March, 1961* £ s. d.
2,077 15 4	New Zealand 3½% Stock, 1960/64 ..	2,077 15 4	1,953 2 0
15,000 0 0	Slough Borough Council loan: to 15th May 1961 at 5¼%	15,000 0 0	15,000 0 0
		£17,077 15 4	£16,953 2 0

(Signed) J. C. HOPKINS,
Director.

COMMONWEALTH INSTITUTE OF BIOLOGICAL CONTROL

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1960

RECEIPTS	Canada			United Kingdom			Total		
	$ c.	£	s. d.	£	s. d.	£	s. d.		
Contributions from Commonwealth and other Governments	19,216.03	7,072	0 0	35,445	15 0	42,517	15 0		
Sale of publications ..	968.44	358	11 0	95	15 0	454	6 0		
Interest:									
General Account ..				752	16 8	752	16 8		
Capital Account ..				463	7 8	463	7 8		
Income from levy on special projects:									
(*a*) Overheads $9,458.47									
(*b*) Use of official cars $7,019.27									
	16,477.74	6,100	12 2			6,100	12 2		
Miscellaneous receipts ..	419.99	155	9 11			155	9 11		
	37,082.20	13,686	13 1	36,757	14 4	50,444	7 5		
Remittances from the United Kingdom ..	53,649.50	20,000	0 0			20,000	0 0		
Exchange difference on revaluation of dollar balances at 31st March, 1960		69	14 10			69	14 10		
Special projects: Receipts from sponsors $79,199.70									
Less: allocated above $16,477.74	62,721.96	23,221	15 1			23,221	15 1		

PAYMENTS	Canada			United Kingdom			Total		
	$ c.	£	s. d.	£	s. d.	£	s. d.		
Directors' Salaries ..	11,007.32	4,075	5 6	214	11 8	4,289	17 2		
Superannuation ..				739	4 10	739	4 10		
Entomologists' Salaries ..	47,122.71	17,446	7 10	882	7 11	18,328	15 9		
Superannuation ..				1,992	19 5	1,992	19 5		
Clerical and Technical Staff Salaries	18,899.91	6,997	7 6	112	9 9	7,109	17 3		
Superannuation ..				372	11 5	372	11 5		
Supplementation of Superannuation and Increases in pensions	620.00	229	11 0			229	11 0		
Travelling expenses ..	2,024.10	749	7 9			749	7 9		
Official cars: running expenses	6,776.36	2,508	16 8			2,508	16 8		
Books, periodicals, etc. ..	799.92	296	3 2			296	3 2		
Issue bulletins and periodical publications ..	833.22	308	9 8	247	12 4	556	2 0		
Freight and postage ..	3,990.06	1,477	5 1	110	10 6	1,587	15 7		
Rent, Maintenance, etc.: Headquarters, Ottawa	385.89	142	17 5			142	17 5		
Field Stations	5,803.33	2,148	11 8			2,148	11 8		
Contribution to Headquarters, accounting charges and audit fee ..				1,070	9 4	1,070	9 4		
Miscellaneous expenses ..	67.50	24	19 10	48	4 5	73	4 3		
Furniture and equipment	1,701.22	629	17 0			629	17 0		
Visits Overseas	1,517.11	561	13 8			561	13 8		
	101,548.65	37,596	13 9	5,791	1 7	43,387	15 4		
Remittances to Canada ..				20,000	0 0	20,000	0 0		
Expenditure on special projects	47,408.14	17,552	1 5			17,552	1 5		

Balances at 1st April, 1959	28,274.94	10,376	2	6	14,242	9	8	24,618	12	2

	$181,728.60	£67,354	5	6	£51,000	4	0	£118,354	9	6

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) F. J. SIMMONDS,
Director.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
5th September, 1961.

Balances at 31st March, 1960:

	£	s.	d.								
United Kingdom:											
Crown Agents for Oversea Governments and Administrations ...	986	7	7								
Joint Consolidated Fund ...	23,000	0	0								
Post Office Savings Bank (capital account)... ...	902	18	8								
F.S.S.U. Suspense ...	319	16	2								
								25,209	2	5	25,209 2 5
	$	c.									
Canada:											
Sundry Imprests	18,678.97										
Treasury	14,092.84										
				32,771.81	12,205	10	4				12,205 10 4
				$181,728.60	£67,354	5	6	£51,000	4	0	£118,354 9 6

Investments at 31st March, 1960:	*Cost*	*Market value at 31st March, 1960*
£8,000 Slough Borough Council loan: to 23rd September, 1960 at 5½%	£8,000	£8,000

NOTE: The closing balance in Canada shown above includes an unexpended balance of $16,313.36 of advances received from sponsors of special projects: expenditure on other projects not yet recovered amounts to $3,046.88.

(Signed) T. V. SCRIVENOR, Secretary, Executive Council,
Commonwealth Agricultural Bureaux.

LIST OF SANCTIONED STAFF, BY GRADES

TEN BUREAUX, HEADQUARTERS AND CENTRAL SALES

Secretary	*Assistant Secretary*	*Directors*	*Assistant Directors*	*Scientific Assistants*	*Executive Assistants*	*Indexers*	*Senior Clerical*	*Clerical and Typing*
1 (1)	1 (1)	10 (10)	10 (10)	56½ (55)	3 (—)	9¼ (9)	11 (15)	62½ (60)

INSTITUTES

	Director	*Assistant Director*	*Scientists*		*Executive Assistant*	*Preparators, etc.*		
			A/B	*C*		*D*	*E*	*F/Clerical and Typing*
Entomology	1 (1)	1 (1)	15 (15)	13 (13)	—	6 (9)	4 (3)	7 (7)
Mycology	1 (1)	—	12 (13½)	9 (10)	1 (—)	1 (1)	10 (10)	13 (19)

	Director	*Assistant Director*	*Senior Entomologist*	*Scientists*			*Librarian*	*Clerical and Typing*
				A	*B*	*C*		
Biological Control ..	1 (1)	— (1)	2 (1)	— (5)	2 (2)	8 (5)	1 (1)	10 (3)

Figures in brackets are those recommended by the 1955 Review Conference, see page 50 of the Report. This staff was not necessarily to be worked up to at the beginning of the quinquennium.

Consultant Directors are not included.

LIAISON OFFICERS

UNITED KINGDOM	W. Ness, C.B.E., Agricultural Research Council, Cunard Building, 15 Regent Street, London, S.W.1.
CANADA	G. M. Carman, B.S.A., M.Sc., Ph.D., Chief, Scientific Information Section, Research Branch, Canada Department of Agriculture, Central Exp. Farm, Ottawa, Ontario, Canada.
AUSTRALIA	W. Ives, M.Ec., Commonwealth Scientific and Industrial Research Organisation, 314 Albert Street, East Melbourne, C.2., Victoria, Australia
NEW ZEALAND	N. A. Marris, M.Sc., B.Com., F.N.Z.I.C. (retired), Department of Scientific and Industrial Research, Information Bureau, P.O. Box 8018, Government Buildings, Wellington, C.1, New Zealand.
UNION OF SOUTH AFRICA	Dr. S. J. du Plessis, Department of Agricultural Technical Services, Private Bag 116, Pretoria, Transvaal, Union of South Africa.
INDIA	V. Shankar, I.C.S., Special Secretary, Ministry of Food and Agriculture, (Dept. of Agriculture), New Delhi, India.
PAKISTAN	Taskhir Ahmad, Ph.D. (Cantab.), Director, Department of Plant Protection, Block 52, Pakistan Secretariat, Karachi, Pakistan.
CEYLON	R. W. Wikramanayake, C.C.S., Assistant Secretary to Government, Ministry of Agriculture and Lands, Galle Face Secretariat, Colombo 1, Ceylon.
GHANA	Principal Secretary, Ministry of Agriculture, P.O. Box M.37, Ministry Branch Post Office, Accra, Ghana.
FEDERATION OF MALAYA	Secretary to the Ministry of Agriculture, Federation of Malaya, Swettenham Road, Kuala Lumpur, Malaya.
FEDERATION OF NIGERIA	(to be appointed)
FEDERATION OF RHODESIA AND NYASALAND	G. R. Bates, Ph.D. (London), Chief Botanist and Plant Pathologist, Department of Research and Specialist Services, P.O. Box 8100, Causeway, Salisbury, Southern Rhodesia.
COLONIAL TERRITORIES	Sir Geoffrey Nye, K.C.M.G., O.B.E., B.Sc. (Agr.), C.D.A., Agricultural Adviser to the Secretary of State, Colonial Office, Sanctuary Buildings, Gt. Smith Street, London, S.W.1.
REPUBLIC OF THE SUDAN	Chief, Agricultural Research Division, Ministry of Agriculture, Gezira Research Farm, Wad Medani, Republic of the Sudan.
REPUBLIC OF IRELAND	M. O'Doherty, Department of Agriculture (Economics Division), Dublin, Republic of Ireland.

ADDRESSES

The Executive Council,
Farnham House, Farnham Royal, Bucks.
Telephone—Farnham Common 781
Secretary—Sir Herbert Howard (till 31.12.60)
A. E. Trotman, C.M.G. (till 14.1.61)
Acting Secretary—E. L. Hay, M.B.E. (from 15.1.61)

Central Sales,
Farnham House, Farnham Royal, Bucks.
Telephone—Farnham Common 781

Commonwealth Mycological Institute,
Ferry Lane, Kew, Surrey
Telephone—Richmond 4086/7
Director—J. C. F. Hopkins, D.Sc., A.I.C.T.A.
Assistant Director—H. A. Dade, A.R.C.S.

Commonwealth Institute of Entomology,
c/o British Museum (Natural History),
Cromwell Road, London, S.W.7

Publications Office,
56 Queen's Gate, London, S.W.7
Telephone—Knightsbridge 0067/8
Director—E. O. Pearson, M.A., A.I.C.T.A.
Assistant Director—R. G. Fennah, M.A., A.I.C.T.A.

Commonwealth Institute of Biological Control,
K. W. Neatby Building, Carling Avenue,
Ottawa, Ontario, Canada
Director—F. J. Simmonds, D.Sc.

THE COMMONWEALTH AGRICULTURAL BUREAUX

Commonwealth Bureau of	Consultant Director	Director
Animal Breeding and Genetics— Institute of Animal Genetics, University of Edinburgh, King's Buildings, West Mains Road, Edinburgh, Scotland Tel.: Newington 1535	Prof. C. H. Waddington, C.B.E., Sc.D., F.R.S.	J. P. Maule, M.A., Dip. Agric. (Cantab.), A.I.C.T.A., F.R.S.E.
Animal Health— Central Veterinary Laboratory, New Haw, Weybridge, Surrey Tel.: Byfleet 42826	A. W. Stableforth, D.Sc., M.R.C.V.S., D.V.S.M.	M. Crawford, M.R.C.V.S.
Animal Nutrition— Rowett Research Institute, Bucksburn, Aberdeen, Scotland Tel.: Bucksburn 162	D. P. Cuthbertson, C.B.E., M.D., D.Sc., LL.D., F.R.S.E.	D. Harvey, M.A., B.Sc., Ph.D.
Dairy Science and Technology— National Institute for Research in Dairying, Shinfield, Reading, Berks. Tel.: Reading 83103	Prof. R. G. Baskett, O.B.E., M.Sc., F.R.I.C.	E. J. Mann, N.D.D., C.D.D.
Forestry— Imperial Forestry Institute, Oxford Tel.: Oxford 57185	Prof. M. V. Laurie, O.B.E., M.A.	F. C. Ford Robertson, O.B.E., M.A., B.Sc.
Helminthology— The White House, 103 St. Peter's Street, St. Albans, Herts. Tel.: St. Albans 52126	(Vacant)	J. M. Watson, D.Sc. (Lond.), A.R.C.S. Miss S. M. Willmott, Ph.D., (Acting Director from 21.12.60).
Horticulture and Plantation Crops— East Malling Research Station, East Malling, Kent Tel.: West Malling 3033	F. R. Tubbs, M.Sc., Ph.D., A.R.C.S., D.I.C., F.L.S.	G. K. Argles, Dip. Hort. (Wye), A.I.C.T.A.
Pastures and Field Crops— Hurley, nr. Maidenhead, Berks. Tel.: Hurley 363	William Davies, D.Sc.	A. G. G. Hill, B.A., Agr.B., B.Sc.
Plant Breeding and Genetics— School of Agriculture, Cambridge Tel.: Cambridge 58381, Ext. 63	Professor Sir Joseph B. Hutchinson, C.M.G., Sc.D., F.R.S.	P. S. Hudson, O.B.E., Ph.D.
Soils— Rothamsted Experimental Station, Harpenden, Herts. Tel.: Harpenden 4671	F. C. Bawden, M.A., F.R.S.	G. V. Jacks, M.A.

PRINTED IN ENGLAND UNDER THE AUTHORITY OF HER MAJESTY'S STATIONERY OFFICE
BY HULL PRINTERS LIMITED, WILLERBY, HULL, YORKS.

Wt. P12748/408 K14 10/61 H.P.Ltd. G408

© *Crown copyright* 1961

Published by
HER MAJESTY'S STATIONERY OFFICE

To be purchased from
York House, Kingsway, London W.C.2
423 Oxford Street, London W.1
13A Castle Street, Edinburgh 2
109 St. Mary Street, Cardiff
39 King Street, Manchester 2
50 Fairfax Street, Bristol 1
2 Edmund Street, Birmingham 3
80 Chichester Street, Belfast 1

Commonwealth Agricultural Bureaux
Central Sales Branch, Farnham Royal, Bucks.

or through any bookseller

S.O. Code No. 88-603-0-61*